



United States
Department of
Agriculture

Forest
Service

May 2013



Draft Environmental Impact Statement

Thunder Basin Coal Company, LLC Clinker Mining Addition Project

**Douglas Ranger District
Medicine Bow-Routt National Forests and Thunder Basin National Grassland
6th Principal Meridian
Campbell County, Wyoming**

All or part of Sections 11-14 and 23-26, T43N R70W



The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Thunder Basin Coal Company Clinker Mining Addition Project
Draft
Environmental Impact Statement
Campbell County, Wyoming

Lead Agency:	USDA Forest Service
Cooperating Agencies:	None
Responsible Official:	Phil Cruz, Forest Supervisor, Medicine Bow-Routt National Forests and Thunder Basin National Grassland 2250 E. Richards Douglas, WY 82633
For Information Contact:	Amy Ormseth, Minerals and Lands Program Manager, Medicine Bow-Routt National Forests and Thunder Basin National Grassland 2250 E. Richards Douglas, WY 82633

Abstract: The United States Forest Service (USFS) has prepared a Draft Environmental Impact Statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. The USFS proposes to authorize Thunder Basin Coal Company, LLC to implement clinker (scoria) mining on a portion of the Thunder Basin National Grassland to support adjacent area coal mining activities conducted to meet federal coal lease development obligations subject to the Mineral Leasing Act. Available clinker resources will be exhausted in the near future and additional reserves are necessary to facilitate continued mining. Two alternatives are considered: under Alternative 1 - No Action, mining would not be implemented under this project, but would have the potential to occur on private lands in the surrounding area, and under Alternative 2 - Proposed Action, incremental clinker mining would be implemented on 540 acres of Thunder Basin National Grassland in conjunction with mining on surrounding private lands.

Reviewers should provide the USFS with their comments during the review period of the Draft EIS. This will enable the USFS to analyze and respond to the comments at one time and to use information acquired in the preparation of the Final EIS, thus avoiding undue delay in the decision making process. Reviewers have an obligation to structure their participation in the NEPA process so that it is meaningful and alerts the agency to the reviewers' position and contentions.

Send Comments to:	Phil Cruz, Forest Supervisor, Medicine Bow-Routt National Forests and Thunder Basin National Grassland 2250 E. Richards Douglas, WY 82633
--------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------

Date Comments Must Be Received:

The Draft EIS is open for a 45-day review period beginning on the date that the U.S. Environmental Protection Agency publishes the Notice of Availability in the Federal Register.

EXECUTIVE SUMMARY

The United States Forest Service (USFS) proposes to authorize Thunder Basin Coal Company, LLC (TBCC) to expand the area of its existing clinker (scoria) pit development system to include public domain minerals on parcels of National Forest System (NFS) lands located on the Thunder Basin National Grassland for use as road base material within the existing coal mine. The proposed project is identified as the Clinker Mining Addition Project located in all or portions of Sections 11-14 and 23-26, T43N R70W, 6th Principal Meridian in Campbell County, Wyoming. The permit area is located approximately 12 miles east of Wright, Wyoming along Wyoming State Highway #450, and is in the Mineral Production and Management Area 8.4 of the Hilight Bill Geographic area as described in the TBNG Land and Resource Management Plan (USFS 2002).

The Clinker Mining Addition project area (project area) encompasses 2,937 acres comprised of 1,338 acres of NFS lands and 1,599 acres of private lands. Of this area, a total of 1,022 acres are proposed for mining, consisting of 541 acres of NFS lands and 481 acres of private lands. Mining would occur incrementally over an estimated 21-year period of time, with concurrent mining of adjacent NFS and private lands in a logical progression. Mined out areas would be reclaimed over time as new areas are disturbed.

Project Area Acreage Summary

Area Description	Proposed Mining Area (Acres)	Unmined Area (Acres)	Total Area (Acres)
National Forest System Lands	541	797	1,338
Private Lands	481	1,118	1,599
Clinker Mining Addition Project Area	1,022	1,915	2,937

Totals may vary slightly due to rounding of decimal places in data subsets.

The project area represents the mine permit boundary that would be utilized in the Wyoming Department of Environmental Quality - Land Quality Division (WDEQ-LQD) Permit to Mine application. A Permit to Mine would be required prior to initiation of clinker mining on the NFS lands and/or adjacent private lands.

The project area is adjacent to an active coal mining permit area referred to within this document as the Black Thunder TEAL Amendment Permit Area and predominantly supports upland grassland and shrubland vegetation communities on rolling hills bisected by ephemeral drainages. Reaches of Little Thunder Creek, North Prong Little Thunder Creek, and Burning Coal Draw also occur but will not be affected by the proposed clinker mining.

Proposed Permit Boundary Disturbance Summary

Mining Sequence	Project Area (Acres)		Total Project Area (Acres)	Average Annual New Disturbance on NFS Lands (Acres)	Average Annual New Disturbance on Private Lands (Acres)	Total Average New Annual Disturbance (Acres)
	NFS	PRIVATE				
2015 - 2019	67	112	180	13	22	36
2020 - 2024	99	138	236	20	28	47
2025 - 2029	118	170	289	24	34	58
2030 - 2034	228	61	289	46	12	58
2035	28	0	28	28	0	28
Total Mined	541	481	1,022	---	---	---
Not Mined	797	1,118	1,915	---	---	---
Grand Total	1,338	1,599	2,937	---	---	---

Range of estimated new annual disturbance:

USFS: 13-46 acres

Private: 12-34 acres

Total: 28-58 acres

The USFS has identified a *need* to authorize TBCC to expand the area of its existing clinker pit development system to include public domain minerals on parcels of NFS lands within the project area for use as road base material within the existing coal mine. The *purpose* is to ensure that an adequate supply of clinker is available to support road maintenance and changes in infrastructure necessary for mining of Federal coal leases subject to the Mineral Leasing Act of 1927 and the Federal Coal Amendments Act of 1976.

The NFS lands holding clinker reserves are in close proximity to the active mine permit area where the clinker would be utilized, occur adjacent to private reserves, and in some cases occur between private reserves and the active mine permit area. TBCC currently operates two clinker pits in support of mining operations. Both existing pits will be mined out in the near future and insufficient reserves are available within currently permitted areas to support continued mining operations.

Resource management actions proposed in this Draft Environmental Impact Statement (EIS) apply only to the NFS lands within the project area referenced in this document. This Draft EIS was prepared in compliance with the Revised Medicine Bow-Routt National Forest Thunder Basin National Grassland Land and Resource Management Plan (USFS 2002), the National Environmental Policy Act (NEPA), and other relevant Federal and State laws and regulations.

TBCC submitted a request for consideration to look at the potential scoria areas for mining to the Douglas Ranger District on August 25, 2010 to initiate the evaluation process. The Notice of Intent to Prepare an EIS (NOI) was published in the Federal Register on June 17, 2011 to solicit initial scoping comments. The NOI identified the preliminary issues for consideration in the EIS as:

- wildlife impacts
- watershed impacts
- cultural/paleontological impacts
- adjacent private lands impacts
- grazing permit impacts

Two letters were received in response to the collaboration and public involvement efforts of the NOI. One letter was from the United States Environmental Protection Agency (EPA) and one was from the Wyoming Game and Fish Department (WGFD).

Grassland Plan Consistency: An analysis was completed for the alternatives to determine their consistency with Forest-wide Geographic and Management Area Direction and Standards and Guidelines. Results of the analysis revealed that both the No Action Alternative and Proposed Action Alternative are consistent with the Grassland Plan.

Major conclusions include:

- While mining does affect some USFS resources, effects of the Proposed Action Alternatives were determined to be consistent with the Grassland Plan.
- Mining is supported under the multiple use concept, particularly in the Mineral Production and Development Management Area managed for solid minerals production.

Based upon the effects of the alternatives, the responsible official will decide:

- Whether or not the proposed activities and alternatives:
 - are responsive to the issues raised during Scoping (40 CFR 1501.7)
 - are consistent with Grassland Plan direction
 - meet the Purpose of and Need for Action
 - are consistent with other related laws and regulations for National Forest management activities
- Whether or not the mining should be implemented
- The types of design criteria and/or monitoring requirements necessary for project implementation

ACRONYMS

AML	Abandoned Mine Land
AQD	Air Quality Division
BCY	Bank Cubic Yards
CAA	Clean Air Act
CBNG	Coal Bed Natural Gas
CEQ	Council on Environmental Quality
DRD	Douglas Ranger District
EA	Environmental Analysis
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FRCC	Fire Regime Condition Class
FSM	Forest Service Manual
GHG	Greenhouse Gases
LQD	Land Quality Division
MIS	Management Indicator Species
MBRNF	Medicine Bow-Routt National Forest
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
NFS	National Forest System
NFSR	National Forest System Road
NOI	Notice of Intent
NRCS	Natural Resources Conservation Service
PRB	Powder River Basin
SEO	State Engineer's Office
SIP	State Implementation Plan
SMCRA	Surface Mining Control and Reclamation Act
TBCC	Thunder Basin Coal Company
TBNG	Thunder Basin National Grasslands
TDS	Total Dissolved Solids
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
USACE	United States Army Corps of Engineers
USFS	United States Forest Service
USFWS	United States Fish & Wildlife Service
USGS	United States Geological Survey
WAAQS	Wyoming Ambient Air Quality Standards
WAQSR	Wyoming Air Quality Standards and Regulations
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WQD	Water Quality Division

Table of Contents

Executive Summary	iii
Acronyms	vi
Document Structure.....	ix
Chapter 1. Purpose of and Need for Action	1
Background	1
Existing Conditions.....	4
Desired Conditions.....	4
Purpose of and Need for Action.....	4
Proposed Action.....	4
Decision Framework.....	6
Authorities and Regulations.....	7
Public Involvement	8
Issues.....	9
Other Referenced Documents	12
Chapter 2. Alternatives, Including the Proposed Action.....	12
Introduction.....	12
Alternatives Considered in Detail	12
Alternatives Considered but Eliminated from Detailed Study.....	15
Comparison of Alternatives	17
Chapter 3. Affected Environment and Environmental Consequences.....	19
3.1. Topography, Geology, and Overburden.....	21
3.2. Air	25
3.3. Climate and Meteorology.....	32
3.4. Water Resources	34
3.5. Soils.....	43
3.6. Vegetation	54
3.7. Wetlands	67
3.8. Wildlife and Aquatics	73
3.9. Land Use and Recreation	95
3.10. Travel Management	99
3.11. Scenic Resources.....	102
3.12. Paleontological Resources	104
3.13. Cultural Resources	106
3.14. Fire and Fuels.....	112
3.15. Socioeconomics	116
Short-term Uses and Long-term Productivity	120
Unavoidable Adverse Effects.....	122
Other Required Disclosures	124
Chapter 4. Consultation and Coordination.....	124
Preparers and Contributors.....	124
List of Preparers	124
Chapter 5. Literature Cited	127

List of Figures

Figure 1: Vicinity Map.....	10
Figure 2: Project Area Overview	11
Figure 3: Proposed Mining Sequence	16
Figure 4: Ambient Air Monitoring Stations and 2010 Wind Rose.....	29
Figure 5: Hydrology Summary	41
Figure 6: NRCS Soils Mapping Summary for NFS Lands within Project Area.....	50
Figure 7: NFS Lands Wetland Summary	71
Figure 8: Mining Sequence Within Drill Hole Lek 4 Mile Boundary	84

List of Tables

Table 1: Project Area Acreage Summary.....	5
Table 2: Estimated New Disturbance Acreage Summary.....	5
Table 3: Comparison of Alternative Effects.....	17
Table 4: Cumulative Effects Chart.....	21
Table 5: Mining Progression Summary within Project Area	24
Table 6: Clinker Mining Addition Project Emission Estimates (tons/year)	27
Table 7: Monitored PM ₁₀ Concentrations (µg/m ³) at the Black Thunder Mine	28
Table 8: Monitored PM _{2.5} Concentrations (µg/m ³) at the Black Thunder Mine.....	30
Table 9: Valid Water Rights Summary within Analysis Area.....	38
Table 10: NRCS Soils Mapping within the Project Area	44
Table 11: Suitable Soils Depth Correlation for Proposed Mining Area (TBCC Permit and NRCS Information).....	49
Table 12: Vegetation Community Descriptions.....	55
Table 13: Vegetation Community Sequential Effects of Proposed Action within the Project Area.....	56
Table 14: Threatened, Endangered and Proposed Botany Species Considered and Evaluated	58
Table 15: Sensitive Plant Species Considered and Evaluated.....	59
Table 16: Sensitive Species Habitat Occurrence and Disturbance on NFS Lands within the Project Area.....	61
Table 17: Summary of Species of Local Concern Considered and Evaluated on NFS Lands within the Project Area.....	62
Table 18: Species of Local Concern Habitat Occurrence and Disturbance by Vegetation Community on NFS Lands within the Project Area	63
Table 19: Preliminary Wetlands Inventory Summary for NFS Lands	70
Table 20: Preliminary Wetlands Inventory Summary for Private Lands.....	70
Table 21: Status and Habitat Suitability within the General Analysis Area for USFS Region 2 Sensitive Wildlife Species Identified for the TBNG *	76
Table 22: 2012 Estimated Minimum Sage Grouse Population for TBNG.....	80
Table 23: 2012 Maximum Sage Grouse lek Attendance for Wyoming, Northeast Wyoming and thunder Basin National Grassland.....	80
Table 24: Sage Grouse Males per lek for the Hilight Bill Geographic Area.....	80
Table 25: Determination of Impacts for USFS Region 2 Sensitive Wildlife Species and Management Indicator Species Evaluated under the No Action and Proposed Action Alternatives, and Primary Proposed Action Justifications	92
Table 26: Grazing Allotment Summary for NFS Lands with the Project Area	96
Table 27: Secondary Road Designations Within and Intersecting the Project Area.....	100
Table 28: Northern Mixed Grass Prairie Fire Interval.....	114
Table 29: Fire Regimes.....	114
Table 30: Fire Regime Condition Class.....	115
Table 31: Clinker Mining Revenue/Expense Summary	117

DOCUMENT STRUCTURE

The United States Forest Service (USFS) has prepared this Environmental Impact Statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. The EIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives and is organized into five (5) chapters:

- *Chapter 1. Purpose of and Need for Action:* This chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the USFS informed the public of the proposal and how the public responded.
- *Chapter 2. Alternatives, Including the Proposed Action:* This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies in response to the Notice of Intent (NOI). This discussion also includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- *Chapter 3. Affected Environment and Environmental Consequences:* This chapter describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by environmental component.
- *Chapter 4. Consultation and Coordination:* This chapter provides a list of preparers and agencies consulted during the development of the environmental impact statement.
- *Chapter 5. Literature Cited:* This chapter provides the list of references used in all preceding chapters.
- *Appendices:* The appendices provide more detailed information to support the analyses presented in the EIS.

This EIS incorporates the Project Record (40 CFR 1502.12) by reference. The Project Record contains specialist reports and other technical documentation used to support the EIS analysis and conclusions. Specialist reports completed for this document include Cultural, Paleontological, Botany, and Wildlife resource reports. The Project Record is maintained on file at the Douglas Ranger District Office at 2250 East Richards Street in Douglas, Wyoming 82633.

CHAPTER 1. PURPOSE OF AND NEED FOR ACTION

Background

The USFS proposes to authorize the implementation of clinker mining activities on National Forest System (NFS) lands within the Clinker Mining Addition project area (project area). The proposal is guided by the:

- 2001 Revision of the TBNG Land and Resource Management Plan (USFS 2002)
- 1872 Mining Law, as amended (30 USC §§21-42)
- Mining and Materials Policy Act of 1970 (30 USCA § 21a)
- Federal Land Policy and Management Act (FLPMA) of 1976 (as amended) (43 USCA §§ 1701-84)
- National Materials and Minerals Policy, Research and Development Act of 1980 (30 USCA §§ 1601-05)

The USFS's regulatory responsibilities for oversight of mining activities on Federal lands are set forth in the Forest Service Surface Use Regulations (36 CFR 228, Subpart A) which provide rules and procedures for the use of the surface of NFS lands in conjunction with mineral operations. The regulations direct the USFS to prepare the appropriate level of NEPA analysis and documentation when proposed operations may significantly affect surface resources. The regulations state that an operator is entitled to access in connection with the operation, and that access must be approved in writing before use can begin. The regulations also require the USFS to develop mitigation measures to minimize adverse impacts to NFS lands resources and include requirements for reclamation.

Forest Service Manual (FSM) 2800 also presents specific responsibilities and considerations for dealing with a Plan of Operation, stating that the USFS should minimize or prevent adverse impacts related or incidental to mining by imposing reasonable conditions that do not materially interfere with operation.

Other Federal Laws and Executive Orders

The USFS operates in compliance with other State and Federal regulatory agencies. Laws and executive orders pertaining to project-specific planning and environmental analysis of Federal lands include:

- National Environmental Policy Act of 1969 (as amended)
- National Forest Management Act of 1976 (as amended)
- Multiple-Use Sustained Yield Act of 1960
- Forest and Rangeland Renewable Resources Planning Act 1974 (as amended)
- Endangered Species Act of 1973 (as amended)
- Clean Water Act of 1977 (as amended)
- Clean Air Act of 1970 (as amended)
- National Historic Preservation Act of 1966 (as amended)
- American Indian Religious Freedom Act of 1978 (as amended)
- Archeological Resource Protection Act of 1979 (as amended)

- Bankhead Jones Farm Tenant Act of 1937
- Wyoming Environmental Quality Act, Wyoming Statutes 1977 (as amended)
- Executive Orders:
 - 11593 (cultural resources)
 - 11988 (floodplain management)
 - 12898 (environmental justice)
 - 12962 (aquatic systems and recreational fisheries)
 - 13007 (Indian sacred sites)
 - 13186 (Migratory Bird Treaty Act)
 - 13175 (consultation and coordination with Indian tribal governments)

Grassland Plan Direction

The Thunder Basin National Grassland (TBNG) programmatic management direction document is the Revised TBNG Land and Resource Management Plan (Grassland Plan) for which the Record of Decision is dated July 31, 2002. The Grassland Plan was completed in accordance with applicable laws as identified above, and provides guidance for all resource management activities on the TBNG. It establishes management goals, objectives, standards, and guidelines as well as the availability and suitability of lands for resource management activities. The Grassland Plan can be amended if needed by project level decisions provided the effects of any amendments are evaluated and disclosed in an environmental assessment (EA) or EIS prepared for the project or proposal.

The Grassland Plan sets management allocations for specific uses of land identified as Management Areas to meet multiple use objectives. Ten management areas are identified, to include the 47,990-acre Mineral Production and Development Area encompassing the project area. This area is managed for solid mineral operations with desired condition emphasis on effectively and efficiently removing available commercial mineral resources concurrent with other ongoing resource uses and activities.

Geographic Area Direction

The TBNG encompasses about 572,000 acres of NFS land in the eastern region of Wyoming, and is divided into six Geographic Areas. Geographic areas include management direction that is too specific to apply across an entire grassland or several grasslands. The Proposed Action is entirely within the Hilight Bill Geographic Area. The Hilight Bill Geographic Area encompasses about 100,780 acres of NFS land in east-central Wyoming. This geographic area is located roughly parallel to Wyoming State Highway 59 from Bill to Wright, Wyoming.

Hilight Bill Geographic Area

Desired Conditions

Minerals exploration and development and livestock grazing will be significant management activities in this geographic area. In some areas, there may be restrictions on public use to ensure public safety and to avoid unreasonable interference with mineral operations. In those areas where mining is emphasized, reclamation activities will restore the area to a reasonable level of its pre-mining condition. In areas with other management emphases, existing vegetative diversity and structural conditions will be

maintained and enhanced. This area will have a healthy and diverse mix of grasses, including the following species: western wheatgrass, needle and thread grass, green needlegrass, little bluestem, blue grama, and prairie junegrass.

The streams and riparian areas will be in proper functioning condition or moving towards proper functioning condition. Riparian areas and woody draws will be managed to maintain or enhance different age classes of herbaceous plants, shrubs, and trees. Desired riparian species include sedges, rushes, snowberry, rose, willow, cottonwood, as well as other woody plants. Soils in this geographic area will have high infiltration rates and low soil compaction, resulting in minimal overland flow events.

There will be more development and a moderate number of facilities in this geographical area. Facilities and landscape modifications will be visible, but reasonably mitigated to blend with natural features. Higher fence densities and intensive mineral development may occur.

Mineral developments and facilities such as coal mines, railroads, oil and gas wells, and pipelines will be present and will often dominate the landscape. When mineral activities are concluded, the disturbed lands will be reclaimed to blend in with adjacent undisturbed areas.

Management Area Direction

Management Areas are defined as parts of the grassland that are managed for a particular emphasis or theme. Each management area has a prescription that outlines the Theme, the Desired Conditions, and the Standards and Guidelines that apply to it (in addition to the Grassland-wide Standards and Guidelines). Prescriptions have been broken into eight major categories that range from least evidence of disturbance to most evidence of disturbance. The proposed TBCC Scoria project falls completely within the Mineral Production and Development (8.4) Management Area, which is managed for solid mineral operations.

8.4 Mineral Production and Development

Desired Conditions

Mineral operations of all types are emphasized to effectively and efficiently remove available commercial mineral resources, concurrent with other ongoing resource uses and activities. Operations include development and production of solid minerals, such as coal, bentonite, uranium and hard rock, open-pit mines, stock-piled overburden and top soil, and various ancillary facilities. Facilities and landscape modifications are visible but are reasonably mitigated to blend and harmonize with natural features. Reclamation activities restore the area to a reasonable level of its pre-mining condition. Grazing will occur, except on areas actively being mined and areas under reclamation for bond release.

Restrictions on public use occur to ensure public safety and to avoid unreasonable interference with mineral operations. Visitors can experience frequent encounters with people, heavy equipment, and noise.

Existing Conditions

The *existing condition* is that Thunder Basin Coal Company, LLC (TBCC) coal mining operations are supported by an infrastructure including haul roads and other ancillary facilities which require use of aggregate construction materials (clinker). There is a shortage of available sources of aggregate within the Powder River Basin.

Desired Conditions

The *desired condition* for this project is that the coal mining infrastructure be adequately maintained and reconfigured as necessary to accommodate changes in configuration of the active coal mining areas as coal mining progresses.

Purpose of and Need for Action

The USFS has identified a *need* to authorize TBCC to expand the area of its existing clinker pit development system to include public domain minerals on parcels of NFS lands within the project area for use as road base material within the existing coal mine. The *purpose* is to ensure that an adequate supply of clinker is available to support road maintenance and changes in infrastructure necessary for mining of Federal coal leases subject to the Mineral Leasing Act of 1927 and the Federal Coal Amendments Act of 1976.

TBCC currently operates two clinker pits in support of mining operations. Both existing pits will be mined out in the near future and insufficient minable reserves are available within currently approved areas to support continued coal mining operations. Limited reserves available in the currently permitted area will be utilized in conjunction with the Proposed Project. Movable clinker is geographically limited to areas along what is known as the burn line (indicating the clinker formation process) occurring along the eastern extent of minable coal.

The NFS lands holding clinker reserves are in close proximity to the active mine permit area where the clinker would be utilized, occur adjacent to private reserves, and in some cases occur between private reserves and the active mine permit area. The Proposed Action is consistent with the goals and objectives outlined in the Grassland Plan regarding multiple use and mineral extraction management.

Proposed Action

The USFS proposes to authorize TBCC to expand the area of its existing clinker (scoria) pit development system to include public domain minerals on parcels of NFS lands located on the TBNG. The proposed project is identified as the Clinker Mining Addition Project located approximately 12 miles east of Wright along Highway 450, in all or portions of Sections 11-14 and 23-26, T43N R70 W, 6th Principal Meridian in Campbell County, Wyoming. The permit area is located approximately 12 miles east of Wright, Wyoming along Wyoming State Highway #450, and is in the Mineral Production and Management Area 8.4 of the Hilight Bill Geographic area as described in the TBNG Land and Resource Management Plan (USFS 2002).

The project area encompasses 2,937 acres comprised of 1,338 acres of NFS lands and 1,599 acres of private lands. Of this area, an estimated total of 1,022 acres are proposed for mining including 541 acres of NFS lands and 481 acres of private lands as summarized in Table 1.

Table 1: Project Area Acreage Summary

Area Description	Proposed Mining Area (Acres)	Unmined Area (Acres)	Total Area (Acres)
National Forest System Lands	541	797	1,338
Private Lands	481	1,118	1,599
Clinker Mining Addition Project Area	1,022	1,915	2,937

Mining would occur incrementally, with simultaneous mining of adjacent USFS and private lands in a logical progression. Mined out areas will be reclaimed as soon as practical prior to operations shifting to new areas. Estimated new disturbance area is summarized in Table 2.

The project area represents a management unit consisting of the mine permit boundary that would be utilized in the Wyoming Department of Environmental Quality-Land Quality Division (WDEQ-LQD) Permit to Mine application. Procurement of a Permit to Mine would be required prior to initiation of clinker mining in the project area. This permit would include site specific resource information as well as a mine plan and reclamation plan for the comprehensive area.

Table 2: Estimated New Disturbance Acreage Summary

Mining Sequence	Project Area (Acres)		Total Project Area (Acres)	Average Annual New Disturbance on NFS Lands (Acres)	Average Annual New Disturbance on Private Lands (Acres)	Total Average New Annual Disturbance (Acres)
	NFS	PRIVATE				
2015 - 2019	67	112	180	13	22	36
2020 - 2024	99	138	236	20	28	47
2025 - 2029	118	170	289	24	34	58
2030 - 2034	228	61	289	46	12	58
2035	28	0	28	28	0	28
Total Mined	541	481	1,022	26	23	49
Not Mined	797	1,118	1,915	---	---	---
Grand Total	1,338	1,599	2,937	---	---	---

Totals may differ slightly due to rounding

Range of estimated new annual disturbance:

USFS: 13-46 acres

Private: 12-34 acres

Total: 28-58 acres

The primary use of lands immediately to the north, west, and south of the project area is mining while the primary use to the east is grazing, both of which occur throughout the general area. The Black Thunder and Jacobs Ranch WDEQ-LQD Permits to Mine (as well as another not adjacent to the project area) have been combined into one amendment area referred to within this document as the Black Thunder TEAL Amendment Permit Area.

Pending new coal leases are located within or adjacent to the north and west portions of the Black Thunder TEAL Amendment Permit Area, and one new lease in the southwest portion has recently been acquired by Black Thunder. The clinker burn line indicating the eastern extent of minable coal and the availability of clinker occurs along the east side. See Figure 1: Vicinity Map for the relative location of the project area components and Figure 2: Project Area Overview for details within and around the project area.

Annual new surface disturbance resulting from clinker mining would vary depending on minable clinker depth (supply) and coal mining operations need (demand). Mineral extraction is proposed to occur incrementally over a 21-year period, based on the estimated area of availability, average 15-foot seam depth, and maximum 1.4 million bank cubic yard (bcy) annual need. *Average annual new* disturbance within the EIS area is estimated at 49 acres comprised of 26 acres NFS lands and 23 acres private lands as indicated in Table 2.

The *maximum* total annual surface disturbance including both NFS and private lands within the proposed permit area is estimated at 150 acres to accommodate operations, new mining, and reclamation in progress but not completed to the re-vegetated stage. See Figure 3: Proposed Mining Sequence for the proposed mining area and estimated sequence and timing.

Reclamation activities would occur concurrently with mining. Reclamation to the re-vegetation stage is anticipated within two years of cessation of surface disturbing activities in logical units not required to support ongoing operations. Disturbance area required for operations would include (but not be limited to) access to the removal face, haul roads, the portable crusher and clinker stockpile location, and drainage control away from the pit and crusher locations. Reclamation will fall within the proposed mine permit boundary and will adhere to State and Federal requirements for mining.

Resource management actions proposed in this Draft EIS apply only to NFS lands within the project area.

Decision Framework

Given the purpose and need, the deciding official will review the proposed action, the alternatives, and the environmental consequences to make the following decisions:

- Whether or not the proposed activities and alternatives:
 - are responsive to the issues raised during Scoping (40 CFR 1501.7)
 - are consistent with Grassland Plan direction
 - meet the Purpose of and Need for Action

- are consistent with other related laws and regulations for National Forest management activities
- Whether or not mining will be authorized
- The types of design criteria and/or monitoring requirements necessary for project implementation

Authorities and Regulations

The following statutory authorities and regulations govern the issuance and administration of mineral material disposal on National Forest System lands that apply directly to the lands on proposed authorization.

Materials Act of 1947 as amended. This act was to insure that the Secretaries of Interior and Agriculture had the authority to dispose of minerals reserved to the US on public lands under such rules and regulations as they may prescribe. In addition, the Act was meant to give the Secretary of Agriculture the same authority in disposition of mining materials as to lands under his jurisdiction.

Title V, Federal Land Policy and Management Act of October 21, 1976, (43 U.S.C. 1761-1771). Title V of the Federal Land Policy and Management Act (FLPMA) authorized the Secretary of Agriculture to issue permits, leases, or easements to occupy, use, or traverse National Forest System lands. FLPMA directs the United States to receive fair market value unless otherwise provided for by statute and provides for reimbursement of administrative costs in addition to the collection of land use fees (43 U.S.C. 1764(g)).

Surface Resources Act of 1955. This act was intended to remove common types of sand, gravel, and stone from coverage of the mining laws, and to place disposition of such minerals under the Materials Act of 1947 (30 U.S.C. § 601). After the amendments, the Materials Act was intended to provide for the sale of such “common” materials without disposing of lands which they are found.

Stock Raising Homestead Act of 1916. If the lands in a project proposed area were patented by the United States under the authority of the Stock Raising Homestead Act (SRHA) of 1916, then all entries made and patents issued under this Act are subject to a reservation to the United States of “all coal and other minerals” (43 U.S.C. § 299). In addition, the minerals in such lands remain subject to disposal by the US in accordance with the mineral land laws in force at the time of disposition. Accordingly, if the minerals were reserved under the Stock Raising Homestead Act, then they are considered public domain minerals (never having left federal ownership) and are available for disposal under Federal Land Policy and Management Act and Materials Act of 1947.

Title 36, Code of Federal Regulations, Part 228, Subpart C – Disposal of Mineral Materials. This subpart provides the authorities and regulations on how disposal of mineral materials will occur on National Forest System lands.

Public Involvement

The project was identified in the Schedule of Proposed Actions (SOPA) for the MBRNF since the third quarter of Fiscal Year 2011 (April-June 2011). The NOI was published in the Federal Register on June 17, 2011 requesting initial public comment on the proposal from June 17 - July 20, 2011. In addition, as part of this initial public involvement process, the agency mailed letters to interested parties and published a legal notice in the Laramie Boomerang on June 18, 2011.

Using the comments from the public and other agencies, the interdisciplinary team developed a list of issues to address (see *Issues* section below).

General comments regarding development and scope of the EIS summarized as:

- support of the intent to include the private surface lands in the EIS analysis
- recommendation for discussing a range of alternatives potentially including various phasing scenarios and associated discussion of rationale
- recommendation for discussion of various reclamation scenarios and potential for impact reduction through mitigation and monitoring, if applicable
- recommendations regarding evaluation and disclosure of potential air quality effects, greenhouse gas emissions, and climate change
- recommendations regarding noxious weeds and invasive plants protection
- recommendations regarding cumulative impacts discussions
- recommendations regarding mitigation measures.

The following are the alternatives evaluated in further detail:

- Alternative 1: No Action – NEPA and USFS policies require the study of a No Action Alternative to provide a baseline for comparing the effects of the Proposed Action and other alternatives (40 CFR 1502.14(d) and Forest Service Handbook 1909.14.1). Under the No Action Alternative, no scoria mining would occur on NFS lands within the project area but potential for scoria mining to occur on private lands would remain. All other current activities such as livestock grazing, wildlife use, and recreational opportunities would continue on NFS lands within the project area, and coal mining would continue in the general area.
- Alternative 2: Proposed Action (clinker mining) - The Proposed Action includes incremental mining of 1,022 acres within the 2,937-acres project area. Mining of scoria reserves across an estimated 541 acres of NFS lands would be conducted concurrently with mining on 481 acres of adjacent private lands. Major drainage channels are omitted from the proposed mining area. The active clinker mining area and an undisturbed buffer area would be fenced for safety and mining efficiency, and non-mine related activities other than wildlife use would cease within the fenced area. Activities outside of the exclusion fence would continue in a manner similar to the No Action Alternative.

Issues

The USFS separated the issues into two groups: significant and non-significant issues. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Grassland Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, "...identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)...." No non-significant issues were identified for the Clinker Mining Addition Project.

TBCC submitted a request for consideration to look at the potential scoria areas for mining to the Douglas Ranger District on August 25, 2010 to initiate the evaluation process. The NOI identified the preliminary issues for consideration in the EIS as:

- wildlife impacts
- watershed impacts
- cultural/paleontological resource impacts
- adjacent private lands impacts
- grazing permit impacts.

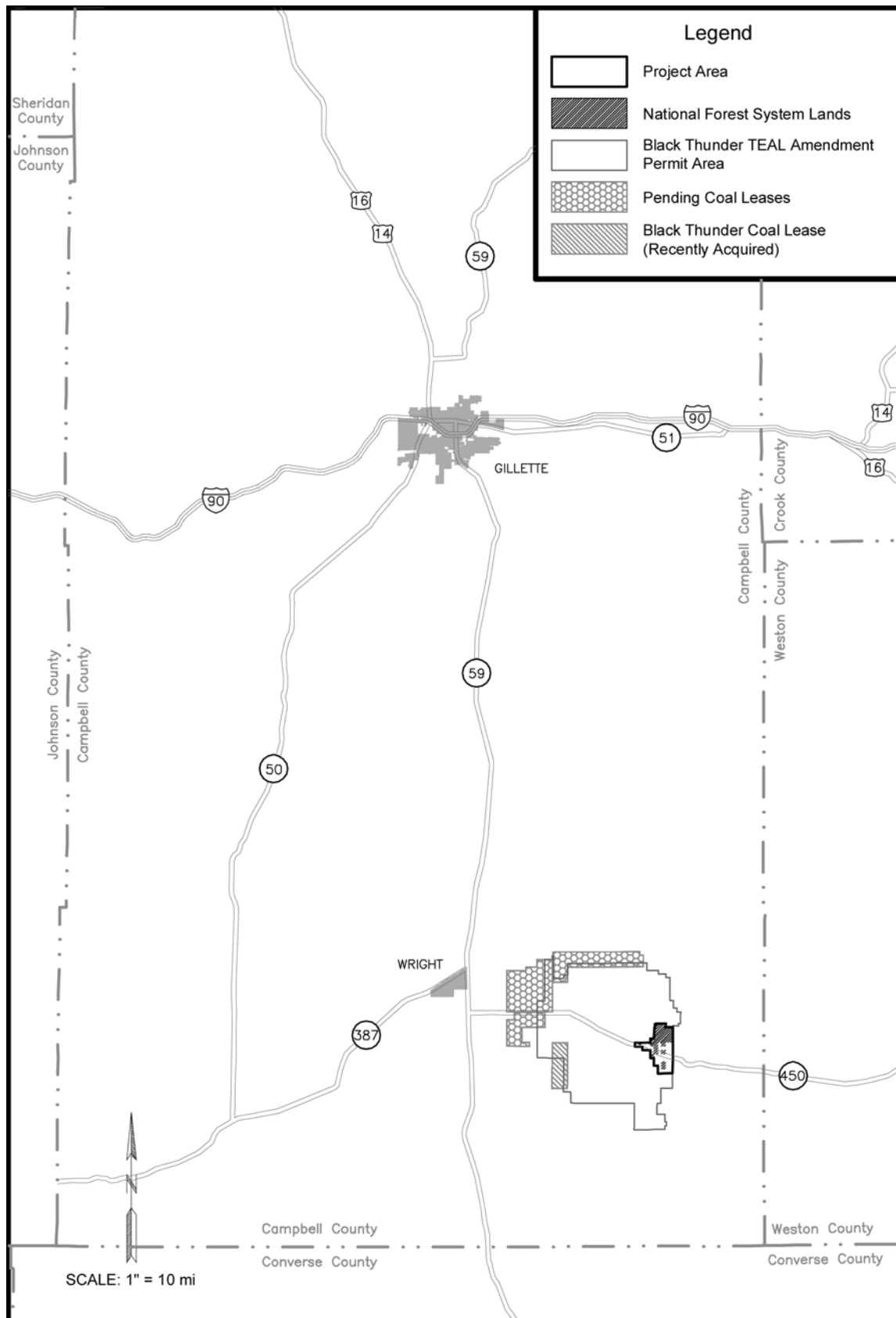


Figure 1: Vicinity Map

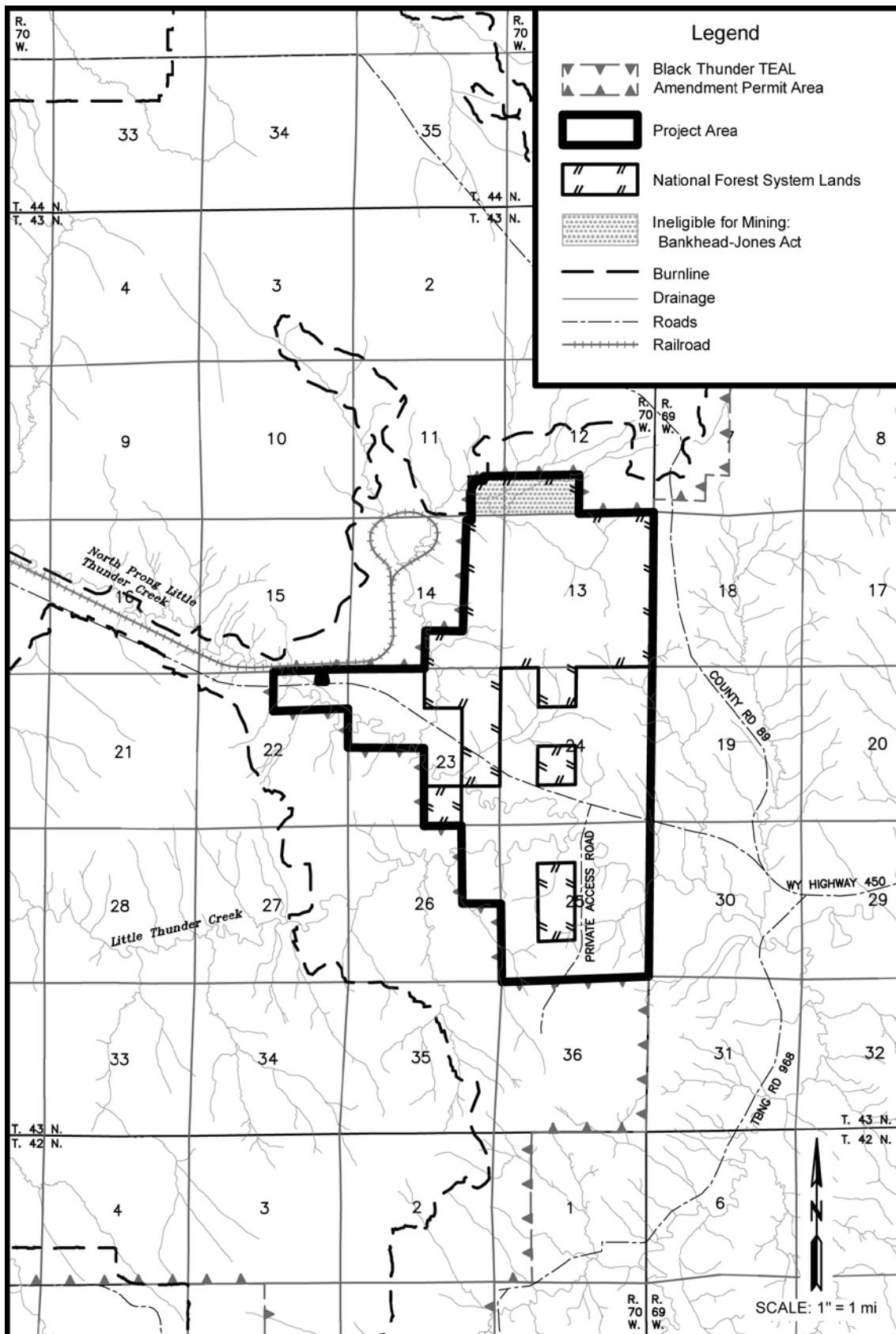


Figure 2: Project Area Overview

Other Referenced Documents

Numerous documents were referenced during completion of this document as indicated in Chapter 5 *Literature Cited*. Primary documents utilized to support baseline information include various Thunder Basin Coal Company documents on file with the WDEQ in Cheyenne, WY to include:

- Black Thunder Mine 2009-2010 Annual Report
- Black Thunder Annual Mine Admin Site Meteorological Data Summary 2006-2010
- Black Thunder Mine 2008-2009 Annual Report
- Black Thunder Mine Permit #233 Appendix D6, 2009 revision
- Black Thunder Mine Permit #233 Thundercloud Amendment, Appendix D7
- Black Thunder Mine Permit #233 Appendix D7, revised 1982
- Jacobs Ranch Mine 2010 Annual Report
- Jacobs Ranch Mine 2009 Annual Report
- Wyoming Department of Environmental Quality Chapter 6, Section 2 Permit Modification Application for Black Thunder Mine
- Final Environmental Impact Statement for the Wright Area Coal Lease Applications – July 2010

CHAPTER 2. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Introduction

This chapter describes the alternatives considered for the project area and includes a map of each alternative considered. This chapter also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative, and some of the information is based upon the environmental, social, and economic effects of implementing each alternative.

Alternatives Considered in Detail

NEPA requires the agency to “Study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources as provided by section 102(2)(E) of the Act.” (40 CFR 1501.2(c)). It is required to develop reasonable alternatives to the proposed action that should still fulfill the purpose and need and address unresolved conflicts related to the proposed action

The USFS developed two alternatives, including the No Action and Proposed Action alternatives. No additional alternatives were developed as a result of issues raised by the public and other agencies in response to the NOI.

Alternative 1

No Action

NEPA and USFS policies require the study of a No Action Alternative to provide a baseline for comparing the effects of the Proposed Action and other alternatives (40 CFR 1502.14(d) and Forest Service Handbook 1909.14.1). Under the No Action Alternative, clinker mining would not occur on NFS lands within the project area under this proposal, but potential for mining would remain on adjacent private lands. Potential for future proposed actions on NFS lands would also remain. Grazing and wildlife use would continue on private lands, and activities such as livestock grazing, wildlife use, and recreation would continue to occur on NFS lands as guided by the Grassland Plan.

Alternative 2

Proposed Action

The Proposed Action and Preferred Alternative (as required by 40 CFR 1502.14(e)) is to expand clinker mining into the project area. Clinker would be incrementally mined in a logical progression from adjacent private and NFS lands. Activities would include, but are not limited to, topsoil stripping, overburden stripping, material stockpiling, mineral extraction, area access, operation of portable crushing facilities, drainage control around the pit and crusher location, construction and maintenance of roads, and ultimate reclamation of the disturbance areas. Material would be transported over haul roads extending from the project area to the adjacent permitted coal mining area.

Clinker reserves would be incrementally mined over an estimated 1,022 acres consisting of 541 acres of NFS lands eligible for mining and 481 acres of adjacent private lands. Over the life of the mine, estimated annual new disturbance is:

- NFS lands: 13-46 acres/year
- Private lands: 12-34 acres/year
- Total lands: 28-58 acres/year

Actual annual disturbance area will depend upon annual needs resulting from site specific weather conditions in association with depth of the reserve in the new disturbance area as well as disturbance area associated with continuing operations and the reclamation schedule. See Table 2 (in Chapter 1) for additional information regarding incremental mining.

Mining would progress as proposed until the minable reserve is exhausted or limiting surface boundaries are encountered. Concurrent reclamation would occur as soon as practical in mined out areas not required for continuing operations. Mining and reclamation would be completed incrementally over an estimated period of 21 years (2015-2035), ultimately depending on resource availability as determined by the thickness and extent of minable scoria and annual need as determined by precipitation, associated ground conditions, and planned construction projects.

Under the Proposed Action Alternative, clinker mining would be conducted on private and NFS lands, and all other activity in adjacent and nearby areas would continue. Grazing would be restricted on the areas being actively mined or involved in the

reclamation process. Public use restrictions would also occur in these areas to ensure public safety and to avoid unreasonable interference with mineral mining operations.

See Figure 3 for the timing and location of proposed clinker mining under the Proposed Action Alternative.

Design Criteria

The following additional resource-specific requirements have also been identified for the proposed project to be completed by TBCC:

- The discovery of any and all antiquities or other objects of historic or scientific interest including, but not limited to, historic or prehistoric ruins, or artifacts as the result of operations under this plan shall immediately be brought to the attention of the Forest Supervisor. The permittee shall cease operations until authorized to proceed by the Forest Supervisor.
- The discovery of any and all fossils or artifacts as the result of operations associated with the proposed project shall immediately be brought to the attention of the Forest Supervisor. The permittee shall cease operations until authorized to proceed by the Forest Supervisor.
- To help protect federally listed species, TBCC and/or the project construction operator will notify the Forest Supervisor should sightings of a federally listed species be discovered during construction or operation of the project. Those reports will occur regardless of whether the species was evaluated in this EIS.
- All operations will remain consistent with TBCC's SMCRA Permit to Mine, including all resources including reclamation requirements.
- Offsite mitigation of \$1,700 in herbicide in order to treat approximately 320 acres of Greater Sage Grouse habitat.
- Timing limitations of March 1st through July 31st will be implemented to protect nesting Greater Sage-Grouse and raptors, will be permanently in place for this project for crushing and large equipment use.
- Noxious weed control measures will be in place.
- Dust abatement control measures will be utilized for the life of the project.

Monitoring

This section explains monitoring as it relates to implementation of the action alternatives. Although monitoring is usually included in the Decision Notice, it is worthwhile for the reader to have an understanding that once the Final EIS is completed, the on-the-ground job really begins. Monitoring can determine whether the project-level decision is being implemented as planned (implementation monitoring) and, if so, whether the objectives identified are being achieved in a timely manner (effectiveness monitoring). If monitoring indicates that desired conditions are not being met, other pre-determined management options included in the project decision may be selected for implementation.

If monitoring indicates that management is meeting standards, or is making measurable progress toward the desired conditions in an acceptable timeframe, the initial management options may continue (FSH 2209.13, Section 95).

Monitoring for this project will include implementation monitoring and effectiveness monitoring for the Grassland Plan Goals, Objectives, Standards and Guidelines, as outlined in Chapter 1, and for the mitigation measures that are determined in the Decision Notice. The following additional resource-specific monitoring requirements to be completed by TBCC have also been identified for the proposed project:

- Annual monitoring for sage grouse will continue for the life of the mine, and would include new permit expansions. Should sage grouse be observed on NFS lands in the wildlife survey areas, appropriate monitoring and mitigation measures would be implemented to minimize impacts to birds, habitats, and populations.
- Monitoring of storm water runoff, erosion control and water quality as required by the applicable WDEQ-WQD permits.
- Monitoring of ambient air quality as required by the applicable WDEQ-AQD permits for the coal mine.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). No public comments providing suggestions for alternative methods for achieving the purpose and need were received in response to the NOI for the Proposed Action. No additional alternatives were considered and eliminated from further analysis in the Draft EIS.

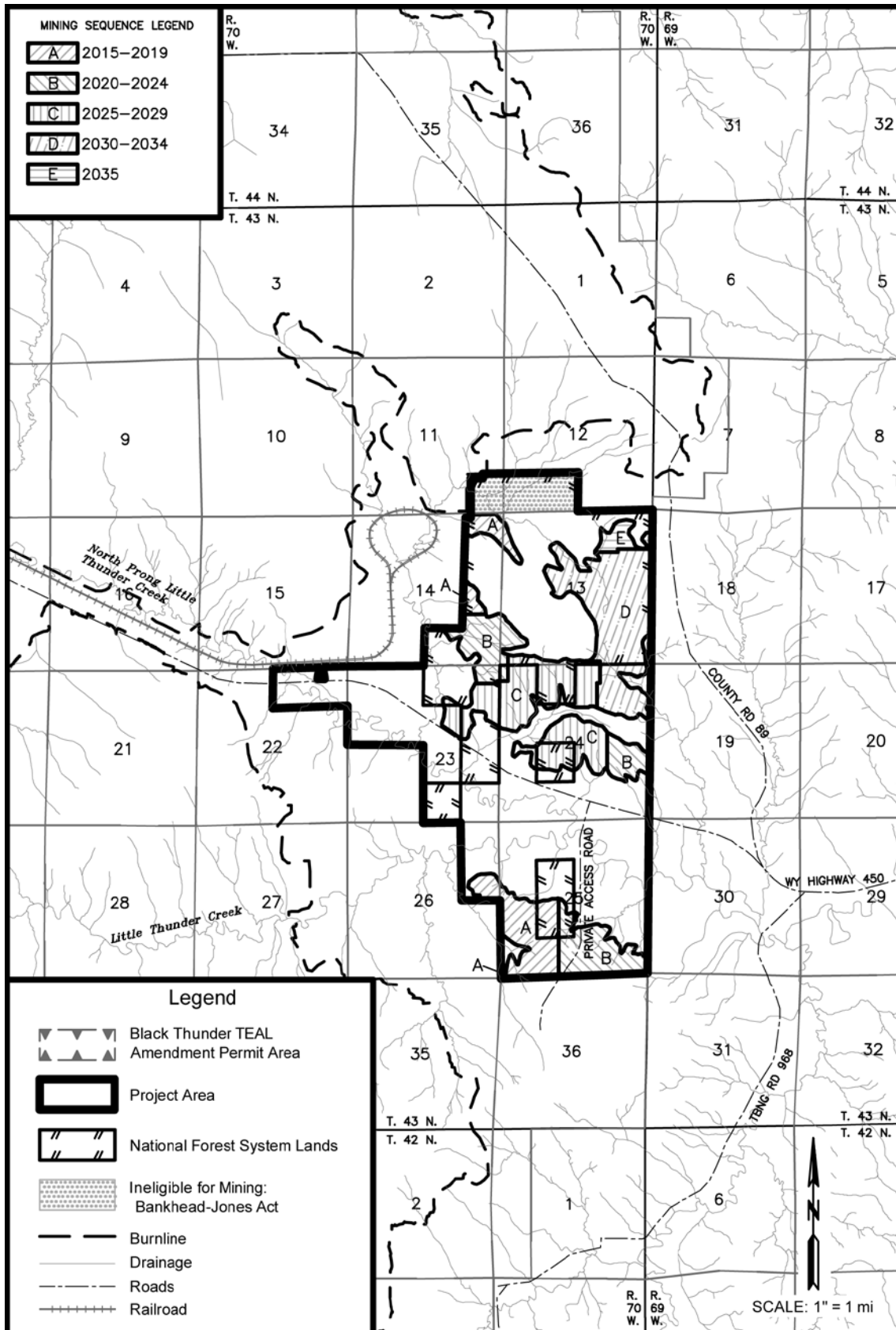


Figure 3: Proposed Mining Sequence

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in Table 3 is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 3: Comparison of Alternative Effects

Affected Resource	Alternative 1 –No Action	Alternative 2 – Proposed Action
Topography, Geology, & Overburden	No effect	Short term affects would consist of drainage control and removal or stockpiling of topsoil, overburden and clinker during the mining process. Long term effects would consist of reclamation areas resembling pre-mine conditions but supporting more consistent and subtle slopes and a slightly lower elevation as determined by depth of clinker extracted.
Air Quality	Potential adverse effect due to increased haul distance to obtain product from alternative source(s).	Potential minor effect: operations would shift from current location to project area with ongoing concurrent reclamation of mined out areas. Air quality would continue to be monitored and remain compliant with Federal and State standards.
Climate and Meteorology	No effect	No effect
Water resources	No effect	Potential short and long term effect of reduced groundwater recharge rates as a result of reduced infiltration rates after clinker removal. Potential short term increase in surface runoff and associated stream flows due to increase in disturbance area. Short term loss of one reservoir that will be replaced. No long term effects due to reclamation and vegetation reestablishment.
Soils	No effect	Short term effects from removal and stockpiling of soils during mining. Long term effects in the form of soil mixing, changes in structure and organic content, and more uniform re-distribution of soil resource during reclamation process.
Vegetation	No effect	Threatened, Endangered and Proposed species: No effect. Sensitive species: May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward Federal listing. Species of local concern: May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward Federal listing.
Vegetation	No effect	Short term effects through removal of communities during mining. Long term effects through change in community composition and structure.

Affected Resource	Alternative 1 –No Action	Alternative 2 – Proposed Action
Wetlands	No effect	Short term effect through removal of one reservoir on a dry ephemeral channel and one playa. Little impact to watershed above reservoir. No long term effect as similar topographic features would be restored during reclamation and mitigation.
Wildlife and Aquatics	Threatened, Endangered and Proposed species: No effect. Sensitive species: May impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward Federal listing. Management Indicator Species: Likely to result in a trend toward Federal listing or loss of viability in the Planning Area. Species of local concern: May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward Federal listing.	Threatened, Endangered and Proposed species: No effect. Sensitive species: May impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward Federal listing. Management Indicator Species: Likely to result in a trend toward Federal listing or loss of viability in the Planning Area. Species of local concern: May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward Federal listing.
Land Use and Recreation	No effect	Short term effect of exclusion of grazing and recreation on portions of the project area. Long term effects would be mitigated by the reclamation process and removal of exclusion areas.
Travel Management	No effect	Short term effect of NFS road closures on portions of the project area. Long term effects would be mitigated by the reclamation process and removal of exclusion areas.
Scenic Resources	No effect	Short term effects would include removal of soils, vegetation, overburden, and the mineral resource. Long term effects would be mitigated by reclamation that will return the area to similar but not exact pre-mine conditions.
Paleontological	No effect	No effect to known resources; design criteria for resources encountered during mining.
Cultural	No effect	No effect to known resources if avoided; design criteria for resources encountered during mining.
Fire and Fuels	No effect	Short term effects through removal of fire fuels during mining. Fire fuels would return with reclamation and may be greater than pre-mine conditions. Potential for increased cheatgrass establishment may increase fuel and fire potential.
Socioeconomics	Short and long term effects in the form of lost Federal and State revenue. May affect life of adjacent coal mine or number of employees.	Short and long term effects through realized Federal and State revenue as well as cost savings to mine supporting life of mine and associated employee base.

Under Alternative 1: No Action, the potential remains for Alternative 2 effects on private lands under separate actions.

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This Chapter summarizes the physical, biological, social, and economic environments of the project area and the effects of implementing each alternative on that environment. It also presents the scientific and analytical basis for the comparison of alternatives presented in the alternatives chapter.

Information is presented by resource section. The analysis area for each section is the project area boundary unless otherwise defined within the section. Area cumulative effects are summarized in Table 4, and are discussed in detail by resource area in this Chapter.

Thunder Basin National Grassland Projects

Cheatgrass Management Analysis. States of Colorado and Wyoming, including the counties of: Garfield, Grand, Jackson, Moffat, Rio Blanco, Routt, Albany, Campbell, Carbon, Converse, Crook, Natrona, Niobrara, Platte, and Weston. This proposal would allow the aerial application of the herbicides Plateau and Journey to treat infestations of cheatgrass acres on the Medicine Bow-Routt National Forest and Thunder Basin National Grassland. This project is in analysis with a projected decision date of May 2012.

Contact: Bob Mountain

Land Management Planning Rule. The Department of Agriculture proposes to promulgate a new planning rule, which will set out the process for development, revision, and amendment of National Forest System land management plans.

Contact: Larry Hayden

Greater Sage Grouse Plan Amendment. The Thunder Basin NG is a cooperating agency in the development of a programmatic EIS to incorporate greater sage-grouse conservation measures into land management plans through plan amendment, including the TBNG plan. The WY BLM is the lead agency.

Contact: Misty Hays.

Analysis Area Projects

Given the above protocol, all activities and facilities located in the analysis area for the proposed project are listed in Table 4. Descriptions of specific projects are provided below. All USFS projects are listed with contact information. Other agency or non-agency projects do not include contact information.

Current Projects within the Proposed Project Area:

- 1. Wright Area Coal Lease by Application (LBA).** Minerals. Contact: Amy Ormseth. Project is located east of Wright, WY. The analysis for this project included the applications for coal leases in the Wright area. The aim of the project was the continuation of coal mining at the Black Thunder and North Antelope Rochelle mines. Analysis was completed in July 2010. Conjectured implementation date is Winter 2013.

- 2. RT Communications, Inc. Keeline to Wright.** Special use. Contact: Geri Proctor. T. 43 N., R. 70 W. (Highways 450, 59, and 387). New fiber optic line would be placed in the right-of-way of WY Highway 450, 90, and 387. This would be on 4.13 miles of NFS land. Conjectured implementation date is Fall 2013.
- 3. Antelope Mine Railroad Spur.** Minerals. Contact: Peter Rose. W¹/₂ SW¹/₄, Section 1; W¹/₂, Section 12; W¹/₂, Section 13; SE¹/₄ SE¹/₄, Section 14, T. 40 N., R. 71 W., Converse County, Wyoming. Antelope Coal, LLC has requested an authorization to amend the existing Antelope Mine special use permit to allow expansion of the railroad spur area associated with expansion and increased capacity of the coal loadout facility. Conjectured EA in September 2013.
- 4. Mackey Road Relocation.** Minerals. Contact: Amy Ormseth. Sections 6, 7, 8, 17, 21, and 22, T. 42 N., R. 69 W.; Sections 29-31, T. 43 N., R. 69 W. Peabody Powder River Mining, LLC has requested an authorization to vacate and re-locate portions of CR 69 Mackey (large segment) and temporary CR 83 Reno (small segment) onto NFS land. Conjectured FEIS in September 2013.
- 5. North Antelope Rochelle Mine – Dewatering.** Minerals. Contact: Angela Bulla. W¹/₂, Section 35, T. 42 N., R. 71 W. (~ 320 acres); N¹/₂ N¹/₂, Section 25 and N¹/₂ NE¹/₄, Section 26, T. 42 N., R. 71 W. (~ 247 acres), Campbell County. The USFS proposes to authorize Peabody Powder River Mining, LLC, operator of the North Antelope Rochelle Mine, right-of-entry access to NFS lands to conduct exploration drilling and install overburden dewatering wells and associated facilities to facilitate full development of their existing federal coal lease (WYW 150210). Conjectured implementation is August 2013.
- 6. Black Thunder Mine – Installation/Construction of Dewatering Wells and Overstripping Area.** Minerals. Contact: Amy Ormseth. The proposed dewatering wells are located on National Forest System lands and consist of two areas. The FS has identified a need to authorize Thunder Basin Coal Company, LLC, operator of Black Thunder Mine, to construct dewatering wells and conduct topsoil and overburden overstripping activities. Conjectured implementation is August 2013.

Table 4: Cumulative Effects Chart

Past	Present	Future
Grazing	Grazing	Grazing
Wildlife	Wildlife	Wildlife
Mining and related	Mining and related	Mining and related
Utilities	Utilities	Utilities
Dispersed Recreation ¹	Dispersed Recreation ¹	Dispersed Recreation ¹
Roads	Roads	Roads
Wildfires ²	Wildfires ²	Wildfires ²
Oil Wells	Oil Wells	Oil Wells
Coal Bed Natural Gas (CBNG) Wells	CBNG Wells	
		Special Use Permits ¹
Range Improvements	Range Improvements	Range Improvements
Travel Management ¹	Travel Management ¹	Travel Management ¹
		Abandoned Mines Rehabilitation

¹ On NFS lands only.

² Undocumented but potential.

On a broader level, extensive areas of surface disturbance have occurred within northeastern Wyoming in support of coal mining, oil production, and CBNG production. The Wright Area Environmental Impact Statement (USDI BLM 2010) identified cumulative coal mine disturbance acres within the Powder River Basin (PRB) in 2007 as 83,593 acres of which 25,884 acres had been permanently reclaimed. Of the total, 45,542 acres of disturbance and 15,785 acres of permanent reclamation occur within the Wright subregion encompassing mines located in the Hilight Bill Geographic Area. A summary of surface disturbance acreage is not available for oil and gas development activities, but 84,017 wells (including all stages of development) have been permitted by county within the PRB (WOGCC 2011). Of the total permitted wells, 54,368 are located in Campbell County, 5,023 in Converse County, 18,073 Johnson County, and 6,553 in Sheridan County.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time, such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line right-of-way or road.

3.1. Topography, Geology, and Overburden _____

3.1.1. Affected Environment

Topography and Physiography

The project area is situated along the burn line in the Rochelle Hills, an area on the eastern edge of the Powder River Basin characterized by rolling hills and steep escarpments. The burn line (see Chapter 1, Figure 2) is a boundary generally oriented

north and south along which the underlying coal seam burned and is considered the eastern extent of mineable coal.

The project area is drained by Little Thunder Creek and several of its tributaries. Little Thunder Creek runs from west to east within the area, and scoria deposits occur in the hills and escarpments on both sides of the creek. Elevation within the project area ranges from 4,600 to 4,852 feet above sea level.

Geology

Surficial deposits within the project area include alluvial and eolian deposits, clinker, and weathered Wasatch Formation overburden (Flores et al. 1999). Alluvial deposits are primarily located along ephemeral stream channels, including Little Thunder Creek. These alluvial deposits consist primarily of poorly to well-sorted, irregularly bedded to laminated sequences of unconsolidated sand, silt, and clay.

The Eocene Wasatch Formation forms most of the overburden within the project area and consists of interbedded lenticular mudstones, siltstones, clayey sandstones, and thin minor coals. Typically, units are gradational mixtures of these sediments. No distinct boundary occurs between the Wasatch and underlying Paleocene Fort Union Formation. From a practical standpoint, the top of the mineable coal zone is considered as the contact between the two formations. The Paleocene Fort Union Formation contains the coal seams mined within the adjacent Black Thunder TEAL Amendment Permit Area. Deeper formations are not directly removed by mining activities.

Mineral Resources

Clinker is the prime mineral of interest within the project area and would be used as road construction and maintenance material within the Black Thunder TEAL Amendment Permit Area near which it occurs. Clinker consists of baked, fused, or melted shales developed in place where the underlying coal seam burned and is generally considered to be part of the Wasatch Formation. Clinker is typically red in color and ranges in texture from porous (similar to volcanic material) to smooth and dense. It is resistant to erosion and is generally a surficial deposit but can be overlain by minor amounts of overburden.

Clinker within the project area is exposed along ridge tops and knolls and ranges in size from small, gravel-sized pieces to large boulders several feet in diameter. According to geology appendices of Powder River Basin mine permits on file with the WDEQ-LQD, clinker is commonly 100 feet thick, and may be as much as 200 feet thick in places (WWRC 1997).

TBCC estimates an average minable clinker depth of 15 feet within the mining sequence area. This depth is based on review of the area, knowledge of local geology, and information from current and historic mining of clinker seams in the adjacent Black Thunder TEAL Amendment Permit Area. Total available material is estimated to be 24,721,049 bank cubic yards (bcy), with 13,082,999 bcy occurring on NFS lands and 11,638,050 bcy occurring on private lands. The project area would provide for the Black Thunder TEAL Amendment Permit Area clinker demand for 21 years based on estimated

availability and maximum annual need of 1.4 million bcy/year of minable material. Private and NFS lands would be mined incrementally under the proposed action as illustrated by the mining sequence shown on Figure 3 in Chapter 2.

Coal within the project area is generally unsuitable for mining due to uneconomic strip ratios and poor quality along the burn line.

The project area overlies geologic structures that may contain producible quantities of oil. Wyoming Oil and Gas Conservation Commission (WOGCC) data indicates that two oil wells have been drilled within the area. Both of these wells were drilled and abandoned, and neither produced oil (WOGCC 2010a).

Review of WOGCC records indicates that no CBNG development occurs within the project area (WOGCC 2010b).

A search of the BLM mining claim index (USDI BLM 2011a) revealed that no active mining claims are located within the project area.

3.1.2. Environmental Consequences

3.1.2.1. Alternative 1 – No Action

Direct and Indirect Effects

Under the No Action Alternative, no mining of clinker or associated disturbance (roads, topsoil stripping, etc.) would occur on NFS lands within the project area but potential for mining would remain on private lands. Topography of undisturbed lands would remain the same and mineral resources would continue to exist in place. Over time, the landscape and local geology would continue to be modified by natural processes such as weathering and erosion.

The project area has been identified and proposed with the State of Wyoming Abandoned Mine Land (AML) Program for reclamation project work to occur. The AML Program has completed a preliminary investigation and design packages to date and has elected to only submit for final evaluation and design should the no action alternative be selected in the decision.

Cumulative Effects

Mining activities within and adjacent to the project area have contributed to changes in area topography and mineral resources. Mining activities would continue to occur in adjacent permitted areas and potential for mining would occur on privately owned lands within the project area. Approximately 11,638,050 bcy of clinker is estimated to be available from private lands within the project area.

3.1.2.2. Alternative 2 – Proposed Action

Direct and Indirect Effects

Under the Proposed Action Alternative, clinker mining would occur on an estimated 541 acres of NFS lands in conjunction with 481 acres of adjacent private lands within the project area. The comprehensive area is expected to provide clinker resources for a period of 21 years (2015-2035) to provide for an estimated maximum annual use of 1.4 million bcy/year.

TBCC's current scoria contract with the USFS (#DGL2800-08-06-09) is effective through 12/31/2015 for a maximum of 1.4 million bcy/year. The mine plan for this project was based upon TBCC's largest scoria production, about 1.3 million bcy/year. Average scoria production is about 840,000 bcy/year.

An average scoria depth of 15 feet is estimated within the mining sequence area along with average annual new surface disturbance of 80 acres per year. Actual material demand would be determined by precipitation levels and extent of haul road or major construction projects while associated new area disturbance would vary depending upon scoria thickness and quality. Reclamation processes would restore topography to conditions similar to (albeit lower than) pre-mine conditions; however, the landscape and geologic composition would remain permanently changed as a result of the clinker extraction. Reclamation of mined out areas would occur concurrently with mining progression.

Extraction of approximately 13,082,999 bcy of clinker from NFS lands in addition to 11,638,050 bcy from private lands (24,721,049 bcy total) is estimated over the expected 21-year life span of the Proposed Action as indicated in Table 5.

Table 5: Mining Progression Summary within Project Area

Mining Sequence (Years)	Private Land Area Mined (Acres)	Private Lands Mineral Resource (Bcy)	National Forest System Land Area Mined (Acres)	National Forest System Land Mineral Resource (Bcy)
2015 – 2019	112	2,718,394	67	1,633,264
2020 – 2024	138	3,330,407	99	2,390,758
2025 – 2029	170	4,121,760	118	2,867,253
2030 – 2034	61	1,467,488	228	5,522,172
2035	0	0	28	669,552
Total	481	11,638,050	541	13,082,999
Comprehensive Total Mined Area (Acres)			1,022	
Comprehensive Total Volume (Bcy)			24,721,049	

Totals may vary slightly due to rounding of decimal places in data subsets.

Mineral extraction over the proposed 541 acres affects 0.5% of the 100,780-acre Hilight Bill Geographic Area and 1% of the 47,993-acre Mineral Production and Development Management Area.

Because alluvial deposits within the project area occur in stream channels rather than upland areas where clinker occurs, they would not be directly impacted by clinker mining. Topsoil and Wasatch overburden overlying mined clinker would be stockpiled and used for reclamation. Formations underlying the clinker resource would remain in place.

The project area has been identified and proposed with the State of Wyoming AML Program for reclamation project work to occur. The AML Program has completed a preliminary investigation and design packages to date and has elected to only submit for final evaluation and design should the no action alternative be selected in the decision. Under the Proposed Action Alternative, reclamation of areas of concern would actually benefit since areas mined for clinker would be reclaimed to stabilize ground resources.

Cumulative Effects

Past coal and clinker mining activities within and adjacent to the project area have contributed to changes in area topography and mineral resources. Coal mining is expected to continue within currently permitted areas and to expand into new areas west of the burn line, and clinker mining would be possible on private lands along the burn line. Clinker mining in the project area under the Proposed Action Alternative will deplete the clinker resource, as it is extracted and used for road construction and maintenance material within the Black Thunder TEAL Amendment Permit Area.

Irreversible and Irretrievable Commitments of Resources

The Proposed Action Alternative would result in incremental irreversible resource commitments. Irreversible commitments would occur in the form of:

- extraction and use of an estimated 13,082,999 bcy of surface or near surface clinker on NFS lands; and
- extraction and use of an estimated 11,638,050 bcy of surface or near surface clinker on Private lands.

Irretrievable impacts will effect topography from the Proposed Action Alternative for a period of time as the scoria is removed and under the reclamation plan returned to an approved condition to as closely match the previous topography of the lands.

3.2. Air

Scope

The scope of this air-quality analysis includes emissions directly associated with clinker removal, handling, and hauling from NFS lands within the project area to the nearby Black Thunder TEAL Amendment Permit Area where the clinker will be utilized. The clinker will be used for road construction and maintenance within the Black Thunder TEAL Amendment Permit Area. Emissions from coal-mining activities near and adjacent to the project area have been extensively analyzed in the Final Environmental Impact

Statement for the Wright Area Coal Lease Applications (Wright FEIS) (USDI BLM 2010) and are outside the scope of this direct analysis but were considered as part of the cumulative effects analysis.

Regulatory Framework

Air-pollution impacts are limited by local, State, tribal, and Federal air quality regulations and standards, in addition to implementation plans established under the Federal Clean Air Act (CAA) which was last amended in 1990. The CAA required the Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. In Wyoming, air-pollution impacts are managed by the Wyoming Department of Environmental Quality, Air Quality Division (WDEQ-AQD), under the Wyoming Air Quality Standards and Regulations (WAQSR), and the EPA-approved State Implementation Plan (SIP). The State of Wyoming has established State ambient air quality standards (or WAAQS). A fundamental requirement of the Federal and State regulations is that ambient concentrations for specific criteria pollutants do not exceed the NAAQS or WAAQS, respectively. Measured ambient concentrations of particulate matter and the associated WAAQS are provided in Table 7 and Table 8 in the Affected Environment section below.

Non-coal mining and quarry operations such as this Clinker Mining Addition Project are required to submit a permit application to the WDEQ-AQD and obtain a construction permit under WAQSR Chapter 6, Section 2 prior to any operations at the non-coal mine or quarry. A construction permit is required for non-coal mining and quarry operations of more than 10 acres.

Conditions of permits issued by the WDEQ-AQD for such projects typically include requirements to treat haul routes, work areas, and stockpiles with water and/or chemical dust suppressants to control fugitive dust. The permits may also include a general condition requiring water sprays at all belt transfer points, shaker screens, and discharge points for any crushing/screening equipment as necessary to limit visible emissions.

Crushers or screens must have a separate, valid air-quality permit. If new equipment of this type is planned for the non-coal mine, a separate air-quality application must be submitted. Previously-permitted equipment with a valid air-quality permit that allows relocation may be moved to the non-coal mine using relocation permit forms provided by the WDEQ-AQD.

Clinker Mining Equipment and Emission Sources

Typically a crawler dozer is used to push in-place clinker to a wheel loader. The wheel loader hauls pit clinker from the dozer push to the crusher. A diesel-powered generator set generates electricity to operate the jaw-crusher unit and associated conveyors. Crushed clinker is stacked in piles by a conveyor on the sized-product side. Wheel loaders load stockpiled, crushed clinker onto haul trucks for transport to the coal mine pit area.

Fugitive-particulate emissions are expected to be produced by wind erosion of disturbed areas, clinker removal with dozers, crushing, product stockpiling and handling, and

unpaved road travel. Point-source (tailpipe) emissions of particulate, NO_x, CO, and SO₂ are expected to be produced by diesel-powered heavy equipment, portable generators, and haul trucks. Although the emission estimates in this analysis consider maximum scoria production conditions, they are presented for informational, not permitting, purposes.

Fugitive-particulate emissions are calculated using the estimated maximum acreage disturbed at any one time and the maximum mining of NFS land mineral resource which occurs in years 2030 – 2034. This amount is adjusted for density and swell and used to calculate average tons per year of clinker produced in those years, which is used to estimate both fugitive PM₁₀ and PM_{2.5} emissions. PM₁₀ and PM_{2.5} are further discussed in Section 3.2.1. The emission estimates are calculated using AP-42 emission factors (USEPA 2009a) and are provided in Table 6.

Point-source emissions from diesel-powered equipment are calculated using regional emission factors from EPA's NONROAD program (USEPA 2009b). These emission estimates are also provided in Table 6.

The Wright FEIS discusses the affected environment for particulate emissions (USDI BLM 2010, p. 3-51) and NO_x emissions (USDI BLM 2010, p. 3-78) in the region including the project area along with ambient air-quality monitoring data and results through 2009. As previously discussed, NO_x emissions associated with the Proposed Action are produced by the clinker mining equipment and not by blasting or by train locomotives. Therefore, the pollutant of primary concern for the project is particulate matter.

Table 6: Clinker Mining Addition Project Emission Estimates (tons/year)

Emission Source	PM ₁₀	PM _{2.5}	NO _x	CO	SO ₂
Wind Erosion	11.25	1.69	--	--	--
Scoria Removal	2.16	2.32	--	--	--
Crushing	0.39	0.07	--	--	--
Product Stockpiling & Handling	4.07	0.6	--	--	--
Unpaved Road Travel	1.47	0.15	--	--	--
Equipment Exhaust	1.04	1.04	18.78	6.66	0.48
Totals	20.4	5.9	18.8	6.7	0.5

3.2.1. Affected Environment

The Federal standard (NAAQS) for particulate matter was specified as total suspended particulates (TSP) until 1987. This measurement included all particulates generally less than 100 microns in diameter. In 1987, the form of the standard was changed from TSP to PM₁₀ to better reflect human health effects. PM₁₀ represents particulate matter with a mean aerodynamic diameter of 10 microns or less that can potentially penetrate into the lungs and cause health problems. In 1997, EPA set separate standards for fine particles (particulate matter with a mean aerodynamic diameter of 2.5 microns or less, or PM_{2.5}) based on their link to serious health problems. In 2006, EPA revised the air-quality standards for particulate matter by tightening the 24-hour fine particle standard from 65

micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) to $35 \mu\text{g}/\text{m}^3$ and by revoking the annual PM_{10} standard of $50 \mu\text{g}/\text{m}^3$. EPA retained the existing annual $\text{PM}_{2.5}$ standard of $15 \mu\text{g}/\text{m}^3$ and the 24-hour PM_{10} standard of $150 \mu\text{g}/\text{m}^3$. These revisions took effect on December 18, 2006.

While retaining the TSP standard until March 2000, Wyoming added the PM_{10} standard to the WAAQS in 1989. Wyoming also adopted a $\text{PM}_{2.5}$ standard in March 2000. In response to EPA's December 2006 revisions to the NAAQS for particulate matter, the state of Wyoming entered into rulemaking to revise the 24-hour $\text{PM}_{2.5}$ standard accordingly. This revision became effective in September 2010.

The Grassland Plan requires that all land management activities comply with all applicable Federal, State, and local air-quality standards and regulations. Emissions from projects on the Grassland must be within Class I or II ranges as specified in Appendix A of the Grassland Plan.

WDEQ-AQD requires monitoring data to document the air quality at all of the PRB coal mines. As a result, the eastern PRB airshed is intensely monitored. TBCC currently operates seven ambient monitoring stations and two meteorological stations in the Black Thunder TEAL Amendment Permit Area. Figure 4 shows the stations in relation to the Black Thunder TEAL Amendment Permit Area and the project area boundaries, and includes wind rose data collected in 2010. Table 7 and Table 8 show PM_{10} and $\text{PM}_{2.5}$ data collected at the monitoring sites over the last few years. Twenty four-hour $\text{PM}_{2.5}$ data is presented for the year that standard went into effect in Wyoming (2010).

Table 7: Monitored PM_{10} Concentrations ($\mu\text{g}/\text{m}^3$) at the Black Thunder Mine

Monitor ID	2008		2009		2010	
	Annual Arithmetic Mean	2 nd High 24-Hour	Annual Arithmetic Mean	2 nd High 24-Hour	Annual Arithmetic Mean	2 nd High 24-Hour
JR-3	28.3	106	22.5	61	17.2	65
JR-4	15.3	48	12.2	33	11.4	36
JR-5	26.6	93	20.8	90	20.9	135
BTM-25	12.3	35	10.2	32	11.5	25
BTM-9	21.3	84	15	49	14.8	44
BTM-36	31.1	98	21.4	73	21.9	92
BTM-12	28.7	91	20.1	71	22.0	89
WAAQS	50	150	50	150	50	150

The Wyoming Ambient Air Quality Standards (WAAQS) are shown for comparison with the measured data.

The annual standard is not to be exceeded.

The 24-hour standard is not to be exceeded more than once per year.

As footnoted in Table 7, the annual PM_{10} standard of $50 \mu\text{g}/\text{m}^3$ is not to be exceeded, and none of the measured concentrations in 2008 – 2010 exceed this standard. The 24-hour standard of $150 \mu\text{g}/\text{m}^3$ is not to be exceeded more than once per year. Therefore, the second-highest measured 24-hour concentrations in 2008 – 2010 are shown in Table 7; none of these values exceed the standard.



Table 8: Monitored PM_{2.5} Concentrations (µg/m³) at the Black Thunder Mine

Monitor ID	2008 Annual Mean	2009 Annual Mean	2010 Annual Mean	3-Year Average of Annual Mean	2010 98 th Percentile 24-Hour Value	3-Year Average of 98 th Percentile 24-Hour
BTM-36	6.6	5.2	4.1	5.3	9.5	N/A
WAAQS				15		35

The Wyoming Ambient Air Quality Standards (WAAQS) are shown for comparison with the measured data. To attain the annual standard, the 3-year average of the annual mean concentration must not exceed 15 µg/m³. To attain the 24-hour standard, the 3-year average of the 98th percentile of 24-hour concentrations must not exceed 35 µg/m³. 98th percentile is the daily value out of a year of monitoring data below which 98 percent of all daily values fall. Wyoming adopted the 35 µg/m³ 24-hour standard effective 9/7/2010; the 2010 98th percentile 24-hour concentration is reported.

In Table 8, three consecutive years of measured data are used to calculate a three-year average for comparison with the annual and 24-hour PM_{2.5} standards. For comparison with the 15 µg/m³ annual standard, the arithmetic mean (average) of the data collected in each calendar year (2008 – 2010) are summed and divided by the number of years (3). The 24-hour data is averaged differently for comparison with the 24-hour 35 µg/m³ standard. For each calendar year, the daily (24-hour) measured value below which 98 percent of all daily values fall is first obtained. Then the 98th percentile values from three consecutive years are summed and divided by three for comparison with the standard. As previously mentioned, Wyoming adopted the standard in 2010, so only the 2010 98th percentile value is presented and cannot be directly compared with the 24-hour standard.

TBCC currently operates two clinker pits in support of mining operations in the Black Thunder TEAL Amendment Permit Area. TBCC's most recent air permit application (TBCC 2010c) to combine the historic Black Thunder and Jacobs Ranch mines, and the corresponding WDEQ-AQD analysis (WDEQ-AQD 2010), demonstrate compliance with ambient air quality standards, the results being inclusive of all operations within the Black Thunder TEAL Amendment Permit Area. With both existing pits being mined out in the near future, the Proposed Action would be a continuation of existing operations in areas adjacent to the current mine operations and is expected to continue operating within ambient air-quality standards as demonstrated by TBCC in the air-permit application and WDEQ-AQD analysis.

3.2.2. Environmental Consequences

3.2.2.1. Alternative 1 – No Action

Direct and Indirect Effects

Under the No Action Alternative, no clinker mining would occur on NFS lands within the project area but the potential for clinker mining on adjacent, private lands would remain. In addition, to offset the shortfall of clinker not mined from the project area NFS lands, clinker would need to be purchased from other sources in the region and hauled to the Black Thunder TEAL Amendment Permit Area.

Direct effects will be the same as the Proposed Action; clinker is expected to be mined at the same rates with similar processes, equipment, and emissions to ensure uninterrupted coal mining of Federal coal leases. However, the clinker would be mined from more local areas on private lands and on other lands in the region farther away from the Black Thunder TEAL Amendment Permit Area. Therefore, it is not likely the No Action Alternative would decrease regional emissions, but relocate the emissions from project area NFS lands to lands farther away from the Black Thunder TEAL Amendment Permit Area.

In addition, the No Action Alternative could actually increase regional emissions by requiring the clinker to be hauled longer distances to the Black Thunder TEAL Amendment Permit Area than it would be hauled from project area NFS lands. It is anticipated public roadways would need to be used to haul the clinker. Indirect effects would include the impacts to public roadways from additional truck traffic causing concerns related to safety (e.g., trucks entering and leaving public roadways, damage to vehicles from unsecured payloads, potential conflicts with other vehicles due to speed, weather, etc.) and maintenance (wear and tear from additional heavy truck traffic).

Cumulative Effects

The Wright FEIS discusses cumulative environmental effects of PRB coal mining activities on regional air quality (USDI BLM 2010). Cumulative effects on air quality from the No Action Alternative will not have any additional effects to air quality since no additional activity would be authorized. Mining will continue to occur in the local area. The USFS did issue a supplemental information report (SIR) to the Wright FEIS based on monitoring data at a nearby mine to show that all air quality concerns (PM10, PM2.5 and others) remained within the air quality regulations even with the additional lease tracts in the Wright FEIS. Air Quality in the area will continue to be monitored from regional air-quality monitoring and modeling from the local mines and consider impacts such as visibility in Class I areas, including the Badlands and Wind Cave National Parks and the Bridger/Fitzpatrick and Cloud Peak Wilderness Areas. As discussed, clinker mining is expected to continue on private lands regardless of this federal action to ensure uninterrupted coal mining of Federal coal leases. The further distances that may be travelled to obtain the gravel from other resources could cumulatively affect this area and others along the routes for a larger effected area.

3.2.2.2. Alternative 2 – Proposed Action

Direct and Indirect Effects

Under the Proposed Action Alternative, clinker mining would take place on the project area. Air emissions from the Proposed Action Alternative are expected to be consistent with current TBCC clinker mining activities in the vicinity which, in conjunction with on-going coal mining activities, have demonstrated compliance with ambient air-quality standards (TBCC 2010c, WDEQ-AQD 2010, and Table 7 and Table 8). As shown in Figure 4, ambient air-quality data is currently monitored in and around the project area, and this monitoring would continue under the Proposed Action Alternative to demonstrate compliance with ambient air-quality standards (WAAQS). Clinker mined away from the project area under the No Action Alternative would not likely be subject

to such monitoring as the ambient air-quality monitoring sites and requirements are established under the adjacent coal mine permits.

Due to the proximity of project area NFS lands to the Black Thunder TEAL Amendment Permit Area where the clinker will be utilized, haul distances are minimized and associated emissions would be reduced from the No Action Alternative. In addition, truck traffic on public roadways would be reduced as compared to the No Action Alternative thus alleviating the safety and maintenance concerns described in Section 3.2.2.1 above.

Cumulative Effects

The Wright FEIS discusses cumulative environmental effects of PRB coal mining activities on regional air quality (USDI BLM 2010, p. 4-44). Cumulative effects on air quality from the Proposed Action would be determined from regional air-quality monitoring and modeling and consider impacts such as visibility in Class I areas, including the Badlands and Wind Cave National Parks and the Bridger/Fitzpatrick and Cloud Peak Wilderness Areas. The WDEQ-AQD would analyze cumulative impacts during the process of TBCC acquiring an air permit for the Proposed Action and would not issue the permit if the Proposed Action cannot meet applicable air-quality standards. Mining will continue to occur in the local area. The USFS did issue a supplemental information report (SIR) to the Wright FEIS based on monitoring data at a nearby mine to show that all air quality concerns (PM10, PM2.5 and others) remained within the air quality regulations even with the additional lease tracts in the Wright FEIS.

Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable impacts to air quality are expected from the Proposed Action Alternative.

3.3. Climate and Meteorology _____

3.3.1. Affected Environment

The climate of the project area is typical of the semi-arid high-plains of northeastern Wyoming and exhibits significant variations in precipitation and seasonal temperatures. The nearest Western Regional Climate Center meteorological station, Rochelle 3 E, Wyoming (NOAA Station ID 487810), is located approximately six miles south of the project area and presents recorded data for a period of record extending from 1927-2002. Data from this station (WRCC 2012) for the period of record is presented below.

Average annual precipitation for the period of record (WRCC 2012) is 12.84 inches, with the highest precipitation occurring in May and June (2.40 and 2.08 inches, respectively) in the form of rain associated with high-intensity, short-duration thunderstorms. The lowest precipitation occurs in December (0.35 inches) and January (0.26 inches). Snowfall averages 37.1 inches per year, with the greatest amounts occurring in March (7.0 inches) and April (5.7 inches).

Summers are generally short and warm while winters are long and cold. Average maximum temperature for the Rochelle 3 E station period of record is 60.0° Fahrenheit

(F) while the average minimum temperature for the same period is 30.0° F. July is the warmest month, with an average maximum temperature of 88.9° F, and January is the coldest month, with an average minimum temperature of 7.5° F. Monthly normals for a 30-year period extending from 1981-2010 indicates a mean annual monthly temperature of 43.5° F (WRCC 2012a).

According to annual meteorological data from within the Black Thunder TEAL Amendment Permit Area boundary (TBCC 2010d), surface wind speeds in the area range from 0-40.2 miles per hour (mph) with an hourly average from 2006-2010 ranging from 8.6-9.2 mph. Extreme wind gusts occur, especially during thunderstorm activity occurring in June, July, and August. Wind speeds are highest in the winter and spring (October through April), with winds predominantly occurring from the west and north. During the warmer months (May through September), wind directions are more random, although winds from the north or south are slightly more predominant. Local variations in wind speed and direction are primarily due to differences in topography. During periods of strong wind, dust may impact air quality across the region.

See Section 3.2 *Air* for additional monitoring information.

3.3.2. Environmental Consequences

3.3.2.1. Alternative 1 – No Action

Direct, Indirect, and Cumulative Effects

No direct, indirect, or cumulative effects on climate would occur as a result of implementing Alternative 1 – No Action.

Mining will continue to occur in the local area. The Wright FEIS estimates direct emissions of GHG because of continuing operations at the Wright area mines. Based on the Wright FEIS analysis, it is assumed that existing land and resource conditions within the region have been and will continue to be affected by climate change (USDI BLM 2011b). These conditions will exist regardless of the alternative selected.

3.3.2.2. Alternative 2 – Proposed Action

Direct, Indirect, and Cumulative Effects

No direct, indirect, or cumulative effects on climate would occur as a result of implementing Alternative 2.

Regarding greenhouse gases (GHG) and climate change, the Wright FEIS (USDI BLM 2010) and the Analysis and Response of Public Comments Received (USDI BLM 2011b) recognize and discuss these issues in depth. The Wright FEIS estimates direct emissions of GHG because of continuing operations at the Wright area mines. The Proposed Action falls directly within such operations as a continuation of the two existing TBCC clinker pits to ensure uninterrupted coal mining of Federal coal leases. Although beyond the scope of this air-quality analysis for the Proposed Action, based on the Wright FEIS

analysis, it is assumed that existing land and resource conditions within the region have been and will continue to be affected by climate change (USDI BLM 2011b).

As mentioned in the Air Quality section above, there is no anticipated increase in emissions that would lead to an increase in GHG therefore there will be no additional impact (direct, indirect, and cumulative) to climate change from the proposed action.

Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable impacts to climate and meteorology are expected from the Proposed Action Alternative.

3.4. Water Resources

Area hydrology data is available in Mine Permits and Annual Reports for the Black Thunder TEAL Amendment Permit Area including the adjacent historic Black Thunder and Jacobs Ranch Mines. The historic Black Thunder Mine area is generally located south of Hwy 450 and encompasses North Prong Little Thunder Creek and Little Thunder Creek while Jacobs Ranch Mine is located north of Hwy 450 and encompasses Burning Coal Draw.

3.4.1. Affected Environment

Groundwater

The primary geologic units containing water-bearing strata within the project area are the Wasatch and Fort Union Formations. The Wasatch Formation of Eocene age consists of interbedded fine-grained sediments and lenticular, discontinuous sandstone units deposited by fluvial systems (Seeland 1992). The Fort Union Formation of Paleocene age underlies the Wasatch and is similar in nature but contains the mineable coal seams characteristic of the Powder River Basin. The Wyodak-Anderson coal seam is generally considered the top of the Fort Union Formation, and of the water-bearing strata occurring within the project area, is the only seam extensive and saturated enough to be considered a regional aquifer.

The Wasatch Formation is overlain by Quaternary Alluvium in the floodplains of Little Thunder Creek and North Prong Little Thunder Creek. These streamlaid, slopewash, and eolian deposits can contain water but are generally only partially saturated. Because clinker mining activities will take place in uplands away from any alluvial deposits, the Quaternary Alluvium is not discussed in further detail.

The sub-coal Fort Union Formation is used for industrial water supply within the Black Thunder TEAL Amendment Permit Area. These units will not be physically disturbed by clinker mining activities and are therefore not discussed in further detail.

Wasatch Formation

In general, the Wasatch Formation (also referred to as the overburden lying above the Wyodak-Anderson coal seam) consists of various deposits including interbedded sandstones, siltstones, and mudstones with occasional discontinuous deposits of carbonaceous material. The Wasatch strata ranges in cohesion from unconsolidated (i.e.,

loose sandstones and siltstones) to lithified (sandstones, siltstones, mudstones, and coal stringers). Any of these deposits may be water bearing, although the sandstones possess a greater, but laterally limited, potential for groundwater yield. These sandstones are generally discontinuous and separated laterally and vertically by fine-grained deposits. The discontinuous nature of the various deposits produces considerable variability in groundwater elevations both laterally and vertically. The hydraulic connection between sandstone lenses is tenuous due to intervening shale aquitards; thus, groundwater movement through the Wasatch Formation overburden is limited. The formation is also composed of interbedded mudstones and claystones which tend to isolate water production units.

Recharge to the Wasatch Formation is primarily through infiltration in upland areas. Some of the water is discharged via evaporation and/or transpiration, while the remainder recharges the underlying coal or moves laterally until it reaches the ground surface. Review of hydrograph data collected by TBCC indicates no general Wasatch Formation recharge or discharge trends within the adjacent portions of the Black Thunder TEAL Amendment Permit Area (TBCC 2010a, TBCC 2010b).

Wasatch Formation aquifer test data collected from overburden tests adjacent to the project area shows wide ranges of transmissivity (10^{-1} ft²/day to 500 ft²/day) (TBCC 2009c) due to the discontinuous and varying nature of the strata. No potentiometric surface map has been developed for the Wasatch Formation for adjacent coal mines, again due to the lack of continuity in water-bearing zones within the Formation. Because the water-bearing units within the Wasatch Formation are not continuous, the Wasatch is not considered to be a regional aquifer. No pre-mining potentiometric surface map was drawn for the Wasatch Formation within the Black Thunder TEAL Amendment Permit Area, as the unit is in an unconfined or semi-confined state depending on location.

Clinker, the mineral to be mined within the project area, is considered part of the Wasatch Formation. It consists of overburden that was baked, fused, and melted in place when the underlying coal burned. These burned sediments have often collapsed into the void left by the burned coal. The occurrence of clinker is site specific, typically occurring in areas where coal seams outcropped at the ground surface. This allows the clinker to be in direct contact with precipitation. Clinker typically does not remain saturated enough to produce useable quantities of water and is not laterally extensive throughout the basin; therefore it is not generally considered a regional aquifer. It is, however, considered to be the primary source of recharge to the adjacent Wyodak-Anderson coal seam. Recharge to the Wasatch overburden also occurs, although its extent is limited by the low permeability of the Formation.

Thickness of the Wasatch formation within the project area is generally low, with no overburden in clinker outcrop areas. Thickness increases to the west, reaching over 300 feet at the western edge of the historic Black Thunder Mine permit boundary (TBCC 2009a).

Wasatch Formation water quality information collected within the adjacent Black Thunder TEAL Amendment Permit Area indicates quality is extremely variable and generally poor. Groundwater does not generally meet Wyoming Department of

Environmental Quality –Water Quality Division (WDEQ-WQD) standards for domestic or agricultural use. Sulfate is typically the dominant anion in overburden groundwater, although bicarbonate dominates in some locations. Dominant cations are typically calcium and magnesium. Wells completed in clinker typically indicate water of a calcium sulfate type (TBCC 2009c).

Wyodak-Anderson Coal

The Tongue River Member of the Fort Union Formation contains the Wyodak-Anderson coal seam which is mined commercially within the nearby Black Thunder TEAL Amendment Permit Area and other mine permit areas. Within the historic Black Thunder Mine permit area, coal is typically 60 to 110 feet thick and occurs in one seam. The Wyodak coal seam is considered a regional aquifer because it is laterally continuous throughout the area.

Information in the historic Black Thunder Mine Permit (TBCC 1982) indicates the primary source of recharge to the coal appears to be clinker outcrop areas, possibly including those located within the project area. Prior to mining, direction of groundwater flow within the coal aquifer was generally from recharge areas along the outcrop of the coal seam westward into the basin, following the dip of the coal. Drawdown of the coal aquifer has occurred due to area mining and CBNG development occurring west of the coal mines.

Groundwater quality in the coal aquifer is generally poor and does not meet all WDEQ-WQD standards for livestock, agricultural, and domestic uses (TBCC 2009a, TBCC 2009b). Sulfate and total dissolved solids (TDS) standards are the most commonly exceeded. Water quality appears to vary according to where wells are located with respect to recharge sources, as coal closer to the burn line tends to be unconfined. Water in the coal seam in these areas tends to be of a mixed type, with calcium, magnesium, sodium, and sulfate as the dominant ions. Groundwater in confined coal further to the west tends to be of a sodium bicarbonate type.

Surface Water

The project area is located above Black Thunder Creek in the Upper Cheyenne River watershed (HUC 10120103). Little Thunder Creek, North Prong Little Thunder Creek, and Burning Coal Draw are the three primary streams within the area. All streams draining the analysis area are categorized as Class 3B (ephemeral/intermittent, supports aquatic life other than fish) by the WDEQ-WQD, with exception of Little Thunder Creek below the confluence with the North Prong Little Thunder Creek. Little Thunder Creek is categorized as 2ABWW (warm water game fishery) between North Prong and the confluence with Black Thunder Creek approximately 27 miles downstream.

Topography within the Little Thunder Creek drainage basin consists of gently rolling hills west of the project area with upland areas becoming more rugged within the project area due to clinker outcrop. Channels in clinker outcrop areas tend to be narrow and steep and consist of grassy swales with little to no pilot channel definition within larger gullies. Evidence of standing water typically exists only in constructed stock reservoirs, and evidence of flow is nearly completely lacking.

Topography in and around the reaches of Little Thunder Creek, North Prong Little Thunder Creek, and Burning Coal Draw is generally flat or gently sloping. These streams are well defined with distinct floodplains. The confluence of Little Thunder Creek and North Prong Little Thunder Creek is located within the project area (see Figure 7: NFS Lands Wetland Summary) with the North Prong flowing from the west and Little Thunder Creek flowing from the southwest. Burning Coal Draw flows from north to south through the project area and joins North Prong Little Thunder Creek upstream from its confluence with Little Thunder Creek.

Runoff in the Little Thunder Creek watershed is typically of short duration and exhibits temporal patterns similar to the precipitation events. According to United States Geological Survey (USGS) data collected on Little Thunder Creek near Hampshire, WY (approximately 33.5 stream miles downstream from the project area) stream flow is normally low to nonexistent from September through January. Stream flow frequently results from snowmelt during the late winter and early spring. Although peak discharges from such events are generally small, the duration and therefore the percentage of annual runoff volume can be considerable. During the spring, storms (both rain and snow) can result in both large runoff volumes and high peak discharges. Intense, short-duration summer thunderstorms can also result in large runoff volumes and high peak discharges.

Portions of Little Thunder Creek and North Prong Little Thunder Creek have been mined through upstream of the project area. Runoff is currently diverted around mining activities or stored in sediment ponds within the Black Thunder TEAL Amendment Permit Area. Burning Coal Draw has also been partially mined upstream of the project area and runoff is stored in a sediment pond approximately 0.1 miles upstream from the project area boundary.

No topographic depressions or springs have been identified within the project area. However, two springs have been identified within two miles of the eastern side of the boundary. One of the springs has been permitted through the Wyoming State Engineer's Office (SEO) (also see Water Rights section below) and has a total depth of 4 feet, a static water level of 4 feet, and a permitted flow of 3 gallons per minute. It is located in the SENW of Section 20, T43N R69W. The other spring is documented on the USGS Piney Canyon NW 1:24,000 scale quadrangle map (USGS 1971) in the NWSW of Section 8, T43N R69W but has not been permitted through the SEO. Details of its depth and flow are unknown.

No natural lakes occur within the project area, but four reservoirs used for livestock watering have been identified. Two of these reservoirs (NWNE Section 13, T43N R70W, and SENW Section 24, T43N R70W) have been permitted through the SEO. The permitted stock reservoirs have been in place for several decades, and the unpermitted stock reservoirs appear to have been in place for a similar time period.

Surface water quality in Little Thunder Creek and its tributaries is highly variable as it is dependent on discharge. Water quality is currently analyzed from six locations (TBCC 2009a). One sampling location occurs within the project area and 2-mile buffer as identified on Figure 5: Hydrology Summary. This sampling location is located in Section

23, T43N R70W, on North Prong Little Thunder Creek. Two other locations occur to the south in Section 11, T42N R70W. Three additional sampling stations occur outside the boundaries of Figure 5; two up channel and one down channel of the project area.

In general, as stream flow increases, TDS concentration decreases and total suspended solids (TSS) concentration increases. Conversely, as stream flow decreases, the TDS concentration increases and the TSS concentration decreases. Due to the sparse vegetative cover and the infrequent occurrence of surface runoff in this semi-arid environment, high TSS concentrations can be expected from large runoff events caused by thunderstorms. Large runoff events also provide for dilution and therefore lower TDS concentrations. Data collected by the adjacent historic Black Thunder Mine at the surface water monitoring (sampling) stations shows TDS concentrations in the general area range from 519 to 2750 mg/L for Little Thunder Creek and TSS concentrations between 17 and 324 mg/L, with TDS and TSS concentrations relating to discharge as described above. No apparent seasonal variation of TDS or TSS concentrations occur (TBCC 2009c).

Data collected by TBCC (2009c) shows that surface water in Little Thunder Creek and North Prong Little Thunder Creek is unsuitable for domestic use due to elevated levels of TDS, sulfate, arsenic, and manganese, and marginal for agricultural use due to elevated TDS levels. The water is typically suitable for livestock and wildlife use.

Water Rights

Mining companies, government agencies, and individual landowners hold the majority of the groundwater rights within the analysis area consisting of the project area and a 2-mile buffer.

Water rights that are not expired, abandoned, or cancelled are defined as valid. Valid water rights records (SEO 2011) identified 277 groundwater rights and 73 surface water rights within the analysis area as presented in Table 9.

Table 9: Valid Water Rights Summary within Analysis Area

Type	NFS lands (#)	Project Area (#)	2-Mile Buffer (#)	Total (#)	Down- stream (#)
Groundwater Right Permits (wells)	0	5 (2 <i>within mining sequence</i>)	272	277	0
Surface Water Right Permits (reservoirs, ditches)	1 reservoir (<i>within mining sequence</i>)	2 (1 reservoir and 1 ditch)	70	73	3 (irrigation ditches)

Italics = number that will be disturbed by the proposed action.

Of the 277 valid, permitted groundwater rights, 150 are wells owned by coal mining companies. The remaining 127 are non-coal mine owned, consisting of 38 wells permitted by private landowners, 25 wells permitted by Atlantic Richfield Company, two (2) wells permitted in association with the Two Elk Power Plant, two (2) wells permitted

by the State of Wyoming, two (2) wells permitted by the University of Wyoming, and 58 wells permitted from unknown sources. Uses associated with these water rights are as follows:

- Monitoring: 145
- Miscellaneous: 90
- Stock: 23
- Miscellaneous and stock: 7
- Domestic: 2
- Domestic and stock: 4
- Industrial: 4
- Domestic, stock, and industrial: 1
- Irrigation: 1

Five of the 277 permitted wells within the analysis area occur within the project area but none occur on NFS lands. Three of the five wells are permitted for stock use and two are permitted for industrial use, although the industrial use wells were not completed as of December 2011 per SEO records. Of the five wells, one uncompleted industrial well and one stock well (Stringer #1) occur within the proposed mining area.

Of the 73 valid, permitted surface water rights, 44 are associated with coal mines, 16 are held by the USFS, 12 are held by private landowners, and one (1) is held by the State of Wyoming. Uses associated with these water rights are as follows:

- Stock: 28
- Industrial: 10
- Industrial and temporary: 8
- Industrial and other: 6
- Flood control and industrial : 3
- Industrial and miscellaneous: 4
- Domestic and irrigation: 3
- Other: 2
- Industrial, recreation, stock, wildlife, and fish propagation: 1
- Fish propagation and stock: 1
- Fish propagation, stock, and wildlife: 1
- Flood control: 1
- Industrial, miscellaneous, and temporary: 1
- Industrial and pollution control: 1
- Industrial and stock: 1
- Reservoir supply: 1
- Stock and wildlife: 1

Uses classified as industrial, pollution control, miscellaneous, or other typically include fire protection, dust abatement, drilling, sediment control, reclamation, and other activities associated with coal mining operations.

Three permitted surface water rights occur within the project area: one reservoir permitted for stock use, one reservoir permitted for stock and wildlife combined uses, and one ditch permitted for domestic and irrigation uses. The reservoir permitted for stock use

occurs on private land outside of the proposed mining area while the one permitted for stock and wildlife uses (J. Jacobs No. F.S. 9-214-4) is located on NFS lands in the NENE of Section 13, T43N R70W and will be disturbed by the proposed action. The permitted ditch is located on private property at the edge of the proposed mining area and was not observed in the field at the location indicated by the SEO records.

Three permitted surface water rights for irrigation ditches occur downstream from the project area on Little Thunder Creek. The nearest downstream surface water right is located approximately 25 stream miles from the eastern edge of the project area.

3.4.2. Environmental Consequences

3.4.2.1. Alternative 1 – No Action

Direct and Indirect Effects

Under the No Action alternative, no clinker would be mined on NFS lands within the project area and no direct impacts to area water rights or groundwater or surface water quantity or quality would occur as a result of the proposed action. Potential for mining on private lands within the project area would remain. Clinker along the burn line (Figure 5) may be in direct contact with the uppermost elevations of the Wyodak coal seam, and if undisturbed would remain in contact with the coal and continue to be a potential source of recharge to the coal aquifer.

The potential remains for development of clinker resources on private lands in the area. Clinker mining on private lands within the project area and surrounding area may alter topography and infiltration rates which may affect surface runoff and flow regimes. Clinker removal from private lands may cause a decrease in recharge to the coal aquifer.

Cumulative Effects

Past activities in adjacent permitted coal mining areas have contributed to changes in the groundwater and surface water regimes, and current mining activities continue to occur in these areas. Surface water replacement would be addressed in detail as part of the WDEQ permitting process and reclamation planning but a time lag would occur and pre and post mining conditions would not be identical. The coal aquifer water level has been and will continue to be affected by area coal removal and CBNG development.

Potential effects to groundwater quality and quantity in both the Wasatch and Fort Union formations may also occur from area coal mining and CBNG development activities. Activities are monitored and reported to the WDEQ for oversight and identification of potential issues.

Mining activity would continue to occur in the Black Thunder TEAL Amendment Permit Area located upstream of the project area, potentially altering the surface water flow regime by removing or otherwise changing the upland topography and stream channels. Sediment control reservoirs have been constructed within the permitted area to protect down gradient areas from potential migration of sediment from disturbed lands. Sediment control reservoirs alter and would be expected to reduce the timing, intensity, and duration of downstream channel flow.

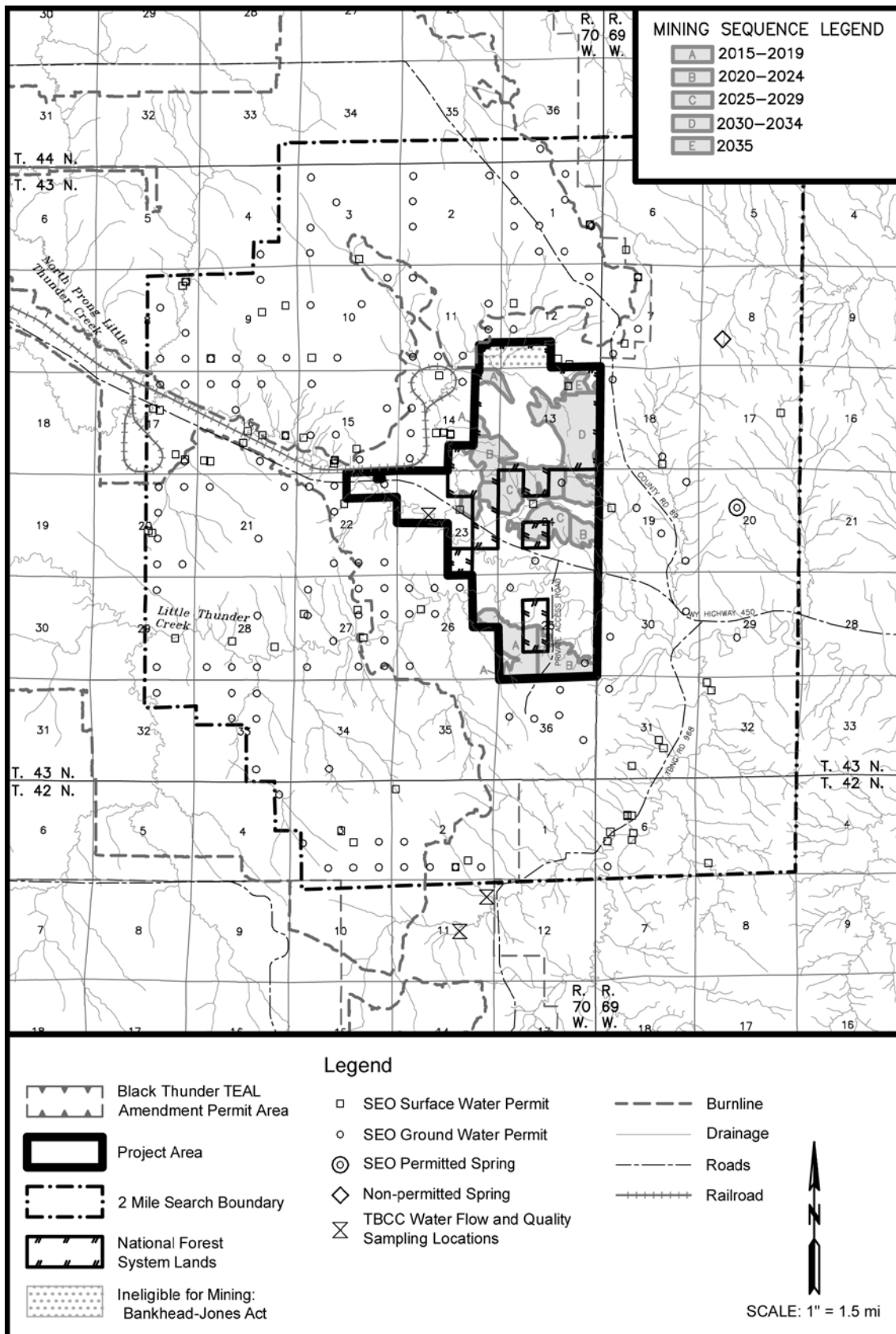


Figure 5: Hydrology Summary

3.4.2.2. Alternative 2 – Proposed Action

Direct and Indirect Effects

Under the Proposed Action alternative, clinker mining would take place on private and NFS lands within the project area. Clinker occurs in upland locations and no streams or aquifers would be directly affected by the proposed action. Clinker outcrop areas promote infiltration and are a possible source of recharge to the adjacent coal aquifer (TBCC 1982). Mined and reclaimed areas may have lower infiltration rates and volumes than pre-mine areas due to replacement of soil material finer than scoria. Over time, increase in the acreage of mined lands could cause an increase in overland runoff from precipitation events, resulting in temporary increases in stream flows. Mining of clinker within the project area could contribute to a decrease in coal aquifer recharge.

Groundwater rights would be affected under the proposed action. Five permitted wells occur within the project area, two of which occur on private lands within the proposed mining area and would be affected by proposed surface disturbing activities. None of the permitted wells occur on NFS lands. Of the five permitted wells, two have not been completed. Of the three completed wells, two appear to be completed in alluvial sediments associated with Little Thunder Creek that would not be affected by the proposed action. The remaining well is within the proposed mining area but has a producing interval between 307 and 350 feet below ground surface; whereas clinker mining generally takes place within 15-30 feet below ground surface. Additionally, coal is known to be shallow in the area, indicating that the well is not completed in an aquifer that would be affected by clinker mining over the long term. The well structure would be impacted during mining, but because the depth of the well is much greater than the depth of mining and is completed in an unconnected formation, no impacts to the aquifer are expected as a result of mining.

One of the four stock reservoirs is located within the project area. The J. Jacobs No. F.S. 9-214-4 reservoir is located in on NFS lands in the NENE Section 13, T43N R70W and would be removed by the proposed action. The upstream drainage area will remain unaffected by the proposed action with the exception of a short section immediately adjacent to the reservoir. Permitted features would be replaced by TBCC either as the same kind and number, or as otherwise requested by the landowner.

Cumulative Effects

Past activities in adjacent permitted coal mining areas have contributed to changes in the groundwater and surface water regimes, and current mining activities continue to occur in these areas. Development of clinker resources may occur on private lands outside of the project area. Potential effects to groundwater quality and quantity in both the Wasatch and Fort Union formations would be expected to continue from area coal mining and CBNG development activities. Oil development may also occur in the area.

Topography and infiltration rates would be altered by area clinker mining which may affect surface runoff and flow regimes.

Mining and reclamation activity would continue to occur in permitted areas located upstream of the project area, altering the surface water flow regime by removing or otherwise changing the upland topography and stream channels. Sediment control reservoirs have been constructed within the upstream Black Thunder TEAL Amendment Permit Area to protect down gradient areas from potential migration of sediment from disturbed lands. Sediment control reservoirs alter the timing, intensity, and duration of downstream channel flow.

Clinker removal within the project area may cause a decrease in recharge to the coal aquifer. The coal aquifer water level has been and will continue to be affected by area coal removal and CBNG development.

Irreversible and Irretrievable Commitments of Resources

No irreversible impacts to water resources are expected from the Proposed Action Alternative. An irretrievable commitment would occur as one permitted stock reservoir from the period of disturbance until replacement construction.

3.5. Soils

3.5.1. Affected Environment

Soils within the project area were mapped by the Natural Resource Conservation Service (NRCS) as part of the Soil Survey of Campbell County, Wyoming, Southern Part (USDA NRCS 2004, USDA NRCS 2011a). The NRCS soils mapping was completed to an Order 3 level consisting of boundary delineation size down to 40 acres or less, with mapping units comprised mostly of soil associations and complexes. Soil boundaries were plotted by observation and interpretation of remotely sensed data enhanced by limited on-site boundary verification completed by traversing representative areas and completing some transects (USDA SSDS 1993). Order 3 mapping is utilized on a broad scale for tasks such as range and community planning and has limited use in project level analysis.

More intensive Order 1-2 level soils mapping has been completed during various studies within the adjacent 41,537-acre Black Thunder TEAL Amendment Permit Area. Order 1-2 mapping consists of delineation size down to 10 acres or less, with mapping units comprised mostly of consociations and complexes reflecting soils with similar depths and chemical and physical properties. This mapping was completed through field observation and boundary verification at closely spaced intervals (USDA SSDS 1993). Mine permit boundaries encompass areas affected by mining activities as well as buffers with no planned surface disturbance. Portions of the historic Jacobs Ranch and Black Thunder Mine boundaries border the project area.

Wyoming statutes establish mining rules and regulations for which WDEQ-LQD has oversight. The rules and regulations establish soil handling practices for topsoil, soil suitable for use as topsoil, and overburden (material between topsoil or suitable soil and the mined resource). Order 1-2 level soil surveys were completed as required within the Black Thunder TEAL Amendment Permit Area as part of the coal mine permitting process administered by the WDEQ-LQD and summarized in Guideline 1 (WDEQ-LQD 1994). Per Guideline 1, dissimilar soils (highly contrasting physical, chemical and/or

suitable soil depth properties) are mapped to a minimum size of two acres while similar soils are mapped to a minimum of five acres. Site specific soils information would also be required by the WDEQ-LQD prior to initiation of mining in the project area.

The NRCS soils mapping identified 18 mapping units within the project area. Fourteen units are mapped on NFS lands as identified in Figure 6, eleven of which are within the affected area. Thirteen units are mapped on private lands, of which six occur within area affected by the mining sequence. Summary information in Table 10 illustrates affects to NRCS soils mapping units by mining sequence on NFS lands and comprehensively for private lands. Percent of total NFS lands is also presented.

Table 10: NRCS Soils Mapping within the Project Area

NRCS Soils Mapping Units	NFS lands Affected Area (Acres)							Mapping Unit within Mined NFS lands (%)	Mapping Unit within Total NFS lands (%)	Private Lands Mined (Acres)	Private Lands Unmined (Acres)	Total Private Lands within Project Area (Acres)	Comprehensive Total within Project Area (Acres)
	2015-2019	2020-2024	2025-2029	2030-2034	2035	Total Mined	Total Unmined						
#101: Arvada, thick surface very fine sandy loam, 0-6% slopes											2	2	2
#102: Arvada, thick surface-Arvada-Slickspots, 0-6% slopes							0	0	0		172	172	172
#113: Bidman-Ulm loam, 0-6% slopes			5	11		16	88	3	8	13	134	147	251
	NFS lands Affected Area (Acres)											ds with in	l with in

NRCS Soils Mapping Units	2015-2019	2020-2024	2025-2029	2030-2034	2035	Total Mined	Total Unmined	Total within Project Area	Mapping Unit within Mined NFS lands (%)	Mapping Unit within Total NFS lands (%)	Private Lands Mined (Acres)	Private Lands Unmined (Acres)		
#148: Forkwood-Ulm loams, 0-6% slopes			0			0	65	65	0	5		44	44	109
#153: Haverdard-Kishona Association, 0-6% slopes							7	7	0	1		258	258	265
#157: Hiland-Bowbac fine sandy loams, 0-6% slopes				2	0	2	92	94	0	7			0	94
#158: Hiland-Bowbac fine sandy loams, 6-15% slopes				84	15	99	33	132	18	10			0	132
#163: Hilight-Wags-Badland complex, 3-45% slopes	11	9	2	5		27	118	145	5	11	25	163	188	333

NRCs Soils Mapping Units	NFS lands Affected Area (Acres)								Mapping Unit within Mined NFS lands (%)	Mapping Unit within Total NFS lands (%)	Private Lands Mined (Acres)	Private Lands Unmined (Acres)	Total Private Lands within Project Area (Acres)	Comprehensive Total within Project Area (Acres)
	2015-2019	2020-2024	2025-2029	2030-2034	2035	Total Mined	Total Unmined	Total within Project Area						
#173: Lawver-Teckla-Wibaux complex, 0-6% slopes									0	0	7		7	7
#177: Maysdorf fine sandy loam, 0-6% slopes									0	0		33	33	33
#180: Maysdorf-Pugsley sandy loams, 6-15% slopes							42	42	0	3		111	111	153
#190: Parmleed-Renohill complex, 3-15% slopes	2			38	8	48	87	135	9	10			0	135
#200: Renohill-Savageton clay loams, 6-15% slopes									0	0		9	9	9

NRCs Soils Mapping Units	NFS lands Affected Area (Acres)								Mapping Unit within Mined NFS lands (%)	Mapping Unit within Total NFS lands (%)	Private Lands Mined (Acres)	Private Lands Unmined (Acres)	Total Private Lands within Project Area (Acres)	Comprehensive Total within Project Area (Acres)
	2015-2019	2020-2024	2025-2029	2030-2034	2035	Total Mined	Total Unmined	Total within Project Area						
#212: Teckla very fine sandy loam, 0-10% slopes			6			6	14	20	1	1			0	20
#219: Torriarents-Torriorthefts complex, reclaimed	35					35	153	188	6	14			0	188
#240: Wibaux- Wibaux, thin solum complex, 6-40% slopes	20	69	88	12		189	74	263	35	20	379	73	452	715
#243: Wibaux, thick solum- Wibaux, channery fine sandy loams, complex, 3-40% slopes		21				21	6	27	4	2	1	35	36	63

NRCS Soils Mapping Units	NFS lands Affected Area (Acres)								Mapping Unit within Mined NFS lands (%)	Mapping Unit within Total NFS lands (%)	Private Lands Mined (Acres)	Private Lands Unmined (Acres)	Total Private Lands within Project Area (Acres)	Comprehensive Total within Project Area (Acres)
	2015-2019	2020-2024	2025-2029	2030-2034	2035	Total Mined	Total Unmined	Total within Project Area						
#245: Wibaux-Shingle-Badland complex, 6-60% slopes			17	75	5	97	17	114	18	9	55	85	140	254
Total:	68	99	118	227	28	541	797	1,338	100	100	481	1,118	1,599	2,937

0 acres indicates <0.5 acres of the mapping unit occurs.

Totals may not add up precisely due to rounding of decimal places in data subsets.

Soil resources within the proposed mining area are composed of a mosaic of map units ranging over a variety of landscapes created in response to time, topography, climate and parent material. NRCS series descriptions indicate deep fine textured Bidman and Ulm loams primarily occupying depositional toe slope positions along ridges or stable drainages and fine, loamy, very deep Hiland and moderately deep Bowbac soils on broad gently sloping plains. Very deep Lawver soils occur on mesas and terraces. Shallow, clayey Hilight soils and moderately deep, fine textured Wags soils occur on ridges and slopes along with Badland areas lacking a soil resource. Shallow Shingle soils also occur on hills and ridges. Moderately deep fine/fine loamy textured Parmleed and Renohill soils occupy ridge backslopes. Teckla soils consist of very deep soils on clinker outcrop terraces. Torriarents and Torriorthents map units address previously mined and reclaimed/re-vegetated areas. The Wibaux series is a very deep series occurring on hills and ridges. Teckla and Wibaux soils are derived from porcelanite, and Lawver occurs over porcelanite, while other series are predominantly derived from shale and to a lesser extent sandstone as indicated in Table 11. Porcelanite is resistant to weathering and provides the primary minable resource, followed by shales and sandstone.

NRCS mapping indicates the majority of the proposed mining sequence occurs over mapping units dominated by Wibaux and Teckla series.

Table 11: Suitable Soils Depth Correlation for Proposed Mining Area (TBCC Permit and NRCS Information)

NRCS Major Series/ Mapping Unit Component ¹	Jacobs Ranch Mine Permit ² (KM 1979)	North Jacobs Ranch Amendment ² (KM 2001)	Black Thunder Mine Permit ² (TBCC 1982)	Thundercloud Amendment ² (TBCC 1999)	NRCS Soil Survey (2004) ³	Average Soil Salvage Depth	Comments
Badland					0	0	No soil. Sandstone and shale parent material.
Bidman	33	24	40	40	---	34	Formed on alluvial fans, fan remnants, hills, and ridges. Soils formed in alluvium are derived from calcareous shale.
Bowbac		24		32	---	28	Formed on ridges, buttes and hills in eolian deposits and residuum derived from calcareous sandstone.
Hiland		30		56	---	43	Formed on alluvial fans, fan remnants, hills and ridges in alluvium and eolian deposits derived from mixed sources.
Hilight					2	2	30% soft shale platelets and 5% hard channers 2-12 inches, shale at 12+ inches. Formed on breaks, ridges and hills in residuum derived from shale.
Parmleed		24			---	24	Formed on hills and ridges in residuum or alluvium derived from shale and sandstone.
Renohill	24	24	30	32	---	28	Formed on hills and ridges in alluvium and residuum derived from shale.
Shingle	12	12	12	12	---	12	Formed on hills and ridges in residuum derived from shale and sandstone.
Teckla		16			---	16	Formed on hills and ridges in alluvium or eolian deposits over residuum weathered from porcelanite.
Torriarents					4	4	Previously disturbed and re-vegetated: 4-inch A and 4-60-inch C horizons. Formed in overburden derived from mining operations.
Torriorhents					5	5	Previously disturbed and re-vegetated: 5-inch A and 5-60-inch C horizons. Formed in overburden derived from mining operations.
Ulm	24	24	50	56	---	39	Formed on alluvial fans, fan remnants, hills, and ridges. Soils formed in alluvium are derived from mixed sources including calcareous shale.
Wags					23	23	Shale at 23". Formed on hills and ridges in alluvium and residuum derived from shale.
Wibaux	14	16	12		---	14	Formed on hills and ridges in alluvium and/or eolian deposits derived from porcelanite.
Wibaux-Shingle-Badland		4 ⁴				4	Badland and Rock Outcrop: similar lack of soils

¹ Major soils series identified by NRCS (2004) mapping within the proposed mining area

² From historic permit information

³ Utilized only when information is not available from Order 1-2 soil surveys on nearby mine permit areas

⁴ Suitable soil depth likely similar to Jacobs Ranch Amendment Wibaux-Shingle-Rock Outcrop because Badlands and Rock Outcrop both have a suitable soil depth of 0 inches.



Soils mapping previously completed within the Black Thunder TEAL Amendment Permit Area borders portions of the project area but does not directly border NFS lands within the area. NRCS mapping for the project area indicated likely occurrence of major soils that correlate with Order 1-2 soil survey information from nearby portions of the Black Thunder TEAL Amendment Permit Area. Order 1-2 surveys completed for the historic Jacobs Ranch Mine (KM 1979), North Jacobs Ranch Amendment (KM 2001), Black Thunder Mine (TBCC 1982), and Thundercloud Amendment (TBCC 1999) permits presented correlation information indicated in Table 11. NRCS mapping and correlated suitable soil depths indicate a preliminary average suitable soil salvage and re-spread depth calculation for mined portions of NFS lands within the project area of 1.4 feet (17 inches) and on private lands of 1.1 feet (14 inches).

Soil types within the project area are expected to be similar to those being salvaged and utilized for reclamation in the adjacent Black Thunder TEAL Amendment Permit Area. Major series identified by NRCS mapping of the NFS lands but not included in the TBCC Order 1-2 surveys for adjacent areas included the Hilight and Wags series along with Torriarents, Torriorthents, and Badlands. Torriarents and Torriorthents identify previously disturbed areas with replaced rather than developed soils and have no Black Thunder TEAL Amendment Permit Area soils mapping counterpart. Badlands are described by the NRCS as lacking soils, similar to the Rock Outcrop inclusion identified within the Black Thunder TEAL Amendment Permit Area. Site specific information collected during the WDEQ-LQD permitting process would provide site specific soils mapping and a more accurate estimate of topsoil/suitable soil volume availability for mine and reclamation planning purposes through weighted average calculations for which site specific information is not currently available.

According to Bowen et al. (2005), shallow (0-20cm) topsoil depths resulted in greater plant diversity and plant species richness, but resulted in lower above ground production and greater bare ground than observed on 40-60cm topsoil depth replacement areas. Water infiltration was comparatively greater on the deeper topsoil depths than on the shallow depths and resulted in greater water storage potential. Soil organic carbon and mass were also greater in the deeper topsoil areas. Placement of shallow topsoil depths can be used as a management practice to enhance plant community diversity and richness but must be carefully considered in the reclamation plan to ensure stability of the landscape because the shallower treatments had greater potential for erosion as indicated by increased bare area.

Shrestha and Ingram (2007) conducted studies comparing resultant bulk density and infiltration rates for various reclamation practices and compared results to one another as well as to an adjacent, native, undisturbed site. Results for all studies indicated that native, undisturbed soils had the lowest bulk density and the highest infiltration rates compared to reclaimed soils. These results suggested that removal and manipulation of soil during mining accompanied by heavy machinery traffic over reapplied topsoil during reclamation may cause some degree of soil compaction relative to undisturbed sites, but results also indicated land reclamation and management measures can be taken during and after mining which may help to improve infiltration rates.

Mining of coarse near-surface clinker soils and replacement with finer soils may contribute to reduction of average soil infiltration rates, resulting in potential for greater runoff and slope soil erosion; however, this may be mitigated by topography and slope moderation resulting from the mining and reclamation process. Procedures such as roughening the re-graded backfill surface prior to soil redistribution and soil preparation by mechanisms such as discing, plowing, or pitting prior to seeding would mitigate surface compaction and also promote soil infiltration rates.

3.5.2. Environmental Consequences

3.5.2.1. Alternative 1 – No Action

Direct and Indirect Effects

Under the No-Action Alternative, no clinker mining would occur on NFS lands within the project area and no impacts to soils would occur in that area from the proposed action. Potential would remain for mining to occur on private lands.

Cumulative Effects

Under the No Action alternative clinker mining would not occur on NFS lands but potential would remain for mining to occur on private lands within the project area. Natural processes and climate cycles would also continue to influence soil development and movement across the area.

Any potential affects to soils as a result of livestock grazing, fencing, recreation, wildlife use or other special use permits approved by the USFS would continue on NFS lands.

3.5.2.2. Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action would result in long term impacts to project area soils affected by mining. Disturbance would occur incrementally as estimated in Figure 6, with an anticipated average of 80 acres of new disturbance per year, a maximum disturbance footprint of 150 acres (including all areas supporting mining and areas not yet reclaimed to the vegetation stage) and an anticipated 2-year time lag between cessation of surface disturbing activities and reclamation to the re-vegetation stage on logical units not required for ongoing mining activities.

The proposed mining process would remove, mix, and ultimately redistribute soil resources over 541 acres of NFS lands. Effects are estimated by NRCS soils mapping information to include 314 acres (58%) of Wibaux dominated mapping units derived from porcelanite, 35 acres (6%) of previously disturbed area, and 190 acres (36%) of soils derived from shale and sandstone parent material. A broad estimate of depth of soil suitable for plant growth, based on consideration of nearby Order 1-2 soils mapping in association with NRCS mapping (in the absence of site specific data) ranges from 0 inches in Badland and Rock Outcrop areas to 39 inches in areas of deep soils as indicated in Table 11. Soil resource availability would be more accurately defined through onsite sampling during the WDEQ-LQD permit application process and may vary considerably from the estimates presented above.

Quality of soils suitable for plant growth would be decreased by stripping, mixing, and stockpiling of soils for a period of time prior to redistribution. Stahl et al. (2002) found that impacts to stockpiled soils are greater than to disturbances in which soils are left in place. Stockpiling topsoil results in negative impacts to soil organic matter, electrical conductivity, total nitrogen content, mycorrhizal fungal spore content, and amount of microbial biomass (Stahl et al. 2002).

Salvaged soils would be mixed, and redistribution would be expected to occur at a more uniform depth than pre-mine soils distribution. Soil chemistry and nutrient distribution would also be expected to be more uniform in mixed soils than in that of unmixed soils.

Cumulative Effects

Soils impacts resulting from the mining and reclamation process would continue to occur in the Black Thunder TEAL Amendment Permit Area and other coal and clinker mines. Any potential affects to soils as a result of grazing, fencing, recreation, wildlife use, USFS off-road or special use permits (on NFS lands only) would continue. Exclusion fences established around the active mining areas would protect internal areas undisturbed by mining activities from potential effects associated with activities other than wildlife use.

Increased soil uniformity in conjunction with reseeded practices would be expected to result in more uniform vegetation cover and productivity across the landscape than found in the pre-mine state. Replaced topsoil would be expected to support stable, self-sustaining, and productive vegetation communities adequate in quality and quantity to support planned post mining land uses generally consisting of rangeland and wildlife habitat. Soil stability would be expected to closely approximate pre-mining conditions after vegetation is reestablished.

Mining and associated reclamation would be completed to WDEQ-LQD standards including soil stabilization and vegetation establishment parameters protecting the area against wind and water erosion. The natural soil development process would continue from the point of reclamation forward. The project would maintain long-term soil productivity, and wetlands, while impacted, would return to normal function over time.

Irreversible and Irretrievable Commitments of Resources

An irreversible commitment would occur in the form of soils permanently changed but not lost. Irretrievable commitments would occur as:

- 541 acres of topsoil or suitable soil on NFS lands until re-spread during reclamation; and
- 481 acres of topsoil or suitable soil on private NFS lands until re-spread during reclamation.

3.6. Vegetation

3.6.1. Affected Environment

General

The project area and surrounding area predominantly support livestock grazing and wildlife use. Accessible NFS lands within the project area also provide potential for dispersed recreational use. Primary use of lands to the north, west, and south of the project area is coal mining and related activities, while primary use of lands to the east is livestock grazing.

Previous disturbances within the project area consist of developed roads, two tracks, and a previously mined area that is re-vegetated/reclaimed. Roads within the project area include a section of State Highway 450, a developed private road, and various two-tracks. County Road 89 is located outside of the project area near the east boundary. The historic mining area is on NFS lands in portions of Sections 12 and 13 and is generally well vegetated and stable.

The project area is comprised predominantly of rolling hills and rock outcrop areas supporting grassland and shrubland vegetation communities, with inclusions of dry ephemeral drainages and reaches of Burning Coal Draw, North Prong of Little Thunder Creek, and Little Thunder Creek. Elevation within the area varies from 4,600 to 4,852 feet according to the US Geological Survey digital raster graphics map.

Vegetation communities within the project area were identified during August 23, 26, and 27, 2010 field visits as Mixed Grass Prairie, Bunchgrass, Crested Wheatgrass, Big Sagebrush Shrubland, Greasewood Shrubland (private lands only), Silver Sagebrush Shrublands (private lands only), Disturbed Lands, Rough Breaks, and Wetlands, with inclusions of dry ephemeral drainages. Mixed Grass Prairie and Sagebrush communities typically occur on rolling hills and within ephemeral drainages, while Bunchgrass occurs on shallow, well drained soils on hills and ridges with shallow to steep slopes. Greasewood communities occur on saline or sodic soils along Little Thunder and North Prong Little Thunder Creek, and Silver Sagebrush occurs in small patches along the creeks. Small areas of Rough Breaks occur, characterized by very shallow soil with sedimentary bedrock at or near the surface and little or no vegetation cover on shallow to steep slopes. Crested wheatgrass occurs in previously disturbed and reseeded areas or in adjacent areas of natural community expansion. The eight communities were generally characterized by dominant species as described in Table 12.

Wetlands and water resources are limited within the project area to portions of Burning Coal Draw, North Prong Little Thunder Creek, Little Thunder Creek, reservoirs, and seasonally moist depressional areas. Resources on NFS lands are limited to one reservoir, one playa, and seasonally moist depressional areas. The seasonally moist depressional areas occur in narrow ephemeral channels located in portions of Sections 11-13. The reservoir and small playa with a seasonally wet center also occur in Section 13. Affected reaches of Burning Coal Draw and the North Prong of Little Thunder Creek are located down channel from Black Thunder TEAL Amendment Permit Area disturbance areas, water diversions, and on-channel discharge control reservoirs. These drainages receive

discharge water in response to Wyoming Pollutant Discharge Elimination System controlled releases. Burning Coal Draw and North Prong Little Thunder Creek are classified as ephemeral, varying from dry (bare or vegetated) to inundated depending upon season, mine discharge events, and precipitation events. Inundation and soil moisture levels vary throughout the growing season.

Table 12: Vegetation Community Descriptions

Vegetation Community	Dominant Species
Mixed Grass Prairie	Bluebunch wheatgrass (<i>Elymus smithii</i>), Blue Gramma(<i>Bouteloua gracilis</i>), threadleaf sedge (<i>Carex filifolia</i>), Needleandthread (<i>Hesperostipa comate</i>), Japanese brome (<i>Bromus japonicas</i>), Cheatgrass (<i>Bromus tectorum</i>), <i>Distichlis stricta</i> (inclusions)
Bunchgrass	Bluebunch wheatgrass (<i>Elymus smithii</i>), Needleandthread (<i>Hesperostipa comate</i>), inclusions of Cheatgrass (<i>Bromus tectorum</i>),
Crested Wheatgrass	Crested wheatgrass (<i>Agropyron cristatum</i>)
Big Sagebrush Shrubland	Big sagebrush (<i>Artemisia tridentate</i>), Blue Gramma(<i>Bouteloua gracilis</i>), threadleaf sedge (<i>Carex filifolia</i>), Needleandthread (<i>Hesperostipa comate</i>), Bluebunch wheatgrass (<i>Elymus smithii</i>), Japanese brome (<i>Bromus japonicas</i>), Cheatgrass (<i>Bromus tectorum</i>)
Greasewood Shrubland	Greasewood (<i>Sarcobatus vermiculatus</i>), Bluebunch wheatgrass (<i>Elymus smithii</i>), Cheatgrass (<i>Bromus tectorum</i>)
Silver Sagebrush Shrubland	Silver sagebrush (<i>Artemisia cana</i>), Bluebunch wheatgrass (<i>Elymus smithii</i>), Cheatgrass (<i>Bromus tectorum</i>)
Disturbed Lands	---
Rough Breaks (with Badland inclusions)	Broom snakeweed (<i>Gutierrezia sarothrae</i>), Rubber rabbitbrush (<i>Ericameria nauseosus</i>), Big sagebrush (<i>Artemisia tridentate</i>), Bluebunch wheatgrass (<i>Elymus smithii</i>),
Dry Ephemeral Drainages	Bluebunch wheatgrass (<i>Elymus smithii</i>), Western wheatgrass (<i>Poa pratensis</i>) Kentucky bluegrass
Wetlands	Various: Prairie cordgrass (<i>Spartina pectinata</i>), Foxtail barley (<i>Hordeum jubatum</i>), Geyer's sedge (<i>Carex geyeri</i>), field sedge (<i>Carex praeegracilis</i>), bulrush (<i>Schoenoplectus americanus</i>), spikerush (<i>Eleocharis palustris</i>), cattail (<i>Typha latifolia</i>).

Section 3.5 above presents soils information for the project area. Soils information was compared with vegetation community occurrence to determine what communities are typically supported by which soils. Teckla and Wibaux soils predominantly support the Bunchgrass vegetation community while Hilight, Shingle, Wags and Badlands soils predominantly support Rough Breaks communities. The remainder of the major soil series predominantly supports a combination of Mixed Grass Prairie and Big Sagebrush communities. Areas of Greasewood occur over Arvada soils, and Silver Sagebrush communities occur over Haverdad or Kishona soils; neither of these communities would be disturbed by the Proposed Action.

The project area is generally well vegetated, with exception of the Rough Breaks community that, by definition, supports low vegetation cover. The Bunchgrass community exhibits interspaced patches of bare ground if not occupied by annual grasses

but is stable under either condition. Soil textures vary throughout the area. Scoria rock outcrops were common in the Bunchgrass community, while soil surface coarse fragment content throughout the project area consisted of varying amounts of sandstones and scoria channers. Soils were generally stable beyond natural wind and water erosion in Rough Breaks areas and one gully with accelerated erosion occurring from Rough Breaks into a previously disturbed area. This gully enters the historic strip mine area discussed below and is on the WDEQ AML Program list for stabilization. Vegetation community occurrence and sequential effects of the proposed action are presented in Table 13.

Table 13: Vegetation Community Sequential Effects of Proposed Action within the Project Area

Mining Sequence (Years)	NFS lands (Acres)								
	Bunch grass	Big Sage brush	Crested Wheat grass	Disturbed Lands	Mixed Grass Prairie	Mixed Grass Prairie – Reclaimed	Rough Breaks	Wet lands	Total
2015 - 2019	14	30	2	0	15	7	0	0	67
2020 - 2024	74	19	0	0	2	2	2	0	99
2025 - 2029	105	14	0	0	0	0	0	0	118
2030 - 2034	114	88	0	0	21	0	4	0	228
2035	9	18	0	0	0	0	0	1	28
Mined Area Total	316	169	2	0	38	9	6	1	540
Unmined Area	62	390	37	3	209	33	53	10	797
Grand Total	378	559	39	3	247	42	59	11	1,337

Totals may vary slightly due to rounding of decimal places in data subsets.

Mining Sequence (Years)	Private Lands (Acres)	Total Project Area (Acres)
2015 - 2019	112	180
2020 - 2024	138	236
2025 - 2029	170	289
2030 - 2034	61	289
2035	0	28
Mined Area Total	481	1,022
Unmined Area	1,118	1,915
Grand Total	1,599	2,937

Historic Surface Strip Mine Area

The NFS lands within the project area include a 42-acre area affected by an historic surface strip mine for which the USFS has no records other than a 2011 notification from WDEQ that work may be done on an erosion feature through the AML Program (Pers. com. Ormseth 2011). Google Earth USGS topography maps identify the area as “Gravel Pit”. The area is located in the SENE and NESE of Section 14, T43N R70W and was either reclaimed or naturally re-established as Mixed Grass Prairie vegetation. It is identified in this document as Mixed Grass Prairie - Reclaimed, and per Table 13 overlaps nine acres of proposed mining area.

Weeds

Two plant species included on the Wyoming list of designated and prohibited noxious weeds (<http://www.wyoweed.org/statelist.html>) occurred within the project area. Isolated Russian olive (*Elaeagnus angustifolia*) saplings occurred along Burning Coal Draw, and isolated patches of Canada thistle (*Cirsium arvense*) also occurred along drainages. One other species of concern occurred within the project area. Significant stands of downy brome (*Bromus tectorum*) occurred predominantly within Bunchgrass and Mixed Grass Prairie vegetation communities. Downy brome is not currently included on the noxious weed list for the State of Wyoming or on the Declared weed list for Campbell County but is a species of concern throughout the State.

USFS Species of Concern

USFS-listed botany species of concern were considered in a Botany Biological Assessment, Biological Evaluation, and Species of Local Concern Report on file at the Douglas Ranger District. The Biological Assessment addresses species given consideration under the Endangered Species Act and was conducted across the project area to address federally-listed Threatened, Endangered or Proposed species identified by the USFS as potentially occurring within the general area. The Biological Evaluation and Species of Local Concern also addressed USFS-listed species potentially occurring within the area but the assessment for those species was limited to NFS lands within the project area. All species potentially occurring within the area and requiring consideration on the TBNG were identified by the USFS pre-field review list (Haynes 2011).

Field surveys were conducted on NFS lands on August 23, 26, and 27, 2010; June 7, 18, and 19, 2011; July 29-31, 2011; and September 4, 2012 to assess habitat suitability and address appropriate survey windows (typical or locally confirmed flowering period for highest visibility) for all potentially occurring vegetation species. Surveys were conducted in typical suitable habitat during the appropriate time frame. All species were considered within the area traveled during each site visit to address potential occurrence in unanticipated habitats or species for which habitat needs are not well defined. The area was traversed in an off-road vehicle supplemented by pedestrian reconnaissance as appropriate. Global positioning system equipment and maps with photo backgrounds were utilized to record vegetation boundaries and other field information.

Threatened, Endangered, and Proposed Species

Two species identified as Threatened, Endangered or Proposed required consideration for occurrence within the project area per the USFS (Haynes 2011) and U.S. Fish and Wildlife Service (USFWS 2011) as identified in Table 14. The species considered and evaluated consisted of blowout penstemon (*Penstemon haydenii*) and Ute ladies' tresses orchid (*Spiranthes diluvialis*) for which no suitable habitat was identified within the project area, no critical habitat has been designated within the project area by the USFWS, and no individuals were observed. Therefore, no further analysis was required for Threatened, Endangered, or Proposed botany species.

Table 14: Threatened, Endangered and Proposed Botany Species Considered and Evaluated

Species Name (Common and Scientific)	Conservation Status	Suitable Habitat within Proposed Permit Area	Rationale for Exclusion if not Carried Forward for Analysis	Brief Habitat and Range Description
Blowout Penstemon <i>Penstemon haydenii</i>	Endangered	No	Suitable habitat lacking in project area (private and NFS lands)	Occurs from 5,860-7,440 feet in elevation (Wyoming) on sparsely vegetated active sand dunes and blowouts. Known from Carbon County, WY and western Nebraska (Heidel 2008).
Ute Ladies' Tresses Orchid <i>Spiranthes diluvialis</i>	Threatened	No	Suitable habitat lacking in project area (private and NFS lands)	Occurs on seasonally moist soil or wet meadows below 7,000 feet in elevation, generally on sub-irrigated or seasonally flooded areas in valley bottoms or along streams (Heidel 2007, Fertig 2000). Known from Laramie, Goshen, Converse, and Niobrara counties in WY.

Sensitive Species

Sensitive plant species are those identified regionally by the USFS as species for which population viability is a concern as evidenced by significant current or predicted downward trends in population numbers or density and habitat capability. The project area occurs within the Rocky Mountain Region (Region 2) and analysis for Sensitive species was conducted on NFS lands within the project area.

Eleven (11) Sensitive plant species are listed by the USFS as having known or suspected (biological or geographical) occurrences on the TBNG (Haynes 2011) as summarized in Table 15.

Table 15: Sensitive Plant Species Considered and Evaluated

Species Name (Common and Scientific)	Conservation Status ¹	Suitable Habitat in the Analysis Area	Rationale for Exclusion if not Carried Forward for Analysis	Brief Habitat and Range Description
<i>Astragalus barrii</i> Barr's Milkvetch	S3	Yes	---	Found primarily on dry, sparsely-vegetated rocky prairie breaks, knolls, hillsides, and ridges on calcareous soft shale and siltstone or silty sandstone. Is restricted to upper- and mid-slope topographic positions, often on north and east aspects. Needs pollinator. Documented to occur on the TBNG. Known in Wyoming at elevations from 3,600-6,000 feet.
<i>Botrychium campestre</i> Iowa Moonwort	S1	No	No habitat present in analysis area	Known from a variety of habitats (Anderson and Cariveau 2003) but is primarily found in native, unplowed tall to midgrass prairie systems where dead leaf litter from grasses (thatch) is present. Known habitat occurs at elevations of 3,700-5,000 feet in loess prairie, calcareous soils underlain by limestone, dunes around Lake Michigan, and areas along railroad tracks. Known WY populations occur in the Black Hills.
<i>Botrychium lineare</i> Narrow-leaved Moonwort	S1	No	No habitat present in analysis area	Known from a variety of habitats from 0-10,500 feet in elevation. Generally occurs in montane, moist, early successional habitats (e.g. moist meadows, edges of trails, seeps, and mossy openings in forests) and in open microsites with evidence of slight to moderate disturbances (Beatty et al. 2003). Typically grows in medium high grass on stream and forest edges as well as in upland habitats with other <i>Botrychium</i> species in association with moist zone shrubs and trees (Haynes 2011). The nearest known occurrence is one site in the Black Hills of Crook County, WY followed by others in Roosevelt National Forest in Colorado and Glacier National Park in Montana (Reyher 2004).

Species Name (Common and Scientific)	Conservation Status ¹	Suitable Habitat in the Analysis Area	Rationale for Exclusion if not Carried Forward for Analysis	Brief Habitat and Range Description
<i>Carex alopecoidea</i> Foxtail Sedge	S2	No	No habitat present in analysis area. Outside elevation range of species.	Meadows and on streamsides at elevations of 5,600-5,900 feet, usually in a sedge and willow community (Moore et al. 2006).
<i>Cuscuta plattensis</i> Prairie Dodder	S1	No	Campbell County is outside of the known distributional range of this species	Occurs in sandy prairie communities at elevations of 4,200-4,900 feet and is parasitic on other plants to include <i>Psoralea</i> , <i>Ambrosia</i> , <i>Grindelia</i> , <i>Solidago</i> , and <i>Helianthus</i> species (Haynes 2011).
<i>Eleocharis elliptica</i> Elliptic Spike Rush	NR	No	No habitat present in analysis area. Outside elevation range of species.	Grows in thermal seeps/springs, wetlands, floodplains, and temporarily flooded soils at elevations of 6,200-7,200 feet (Nellessen 2006a).
<i>Eriogonum visherii</i> Visher's buckwheat	---	No	No habitat present in analysis area. Outside elevation range of species.	Badland islands in grassland matrixes at elevations of 1,900-3,000 feet (Ladyman 2006), occurrence documented on the TBNG.
<i>Festuca hallii</i> Plains Rough Fescue	S2	No	No habitat present in analysis area. Outside elevation range of species.	Is associated with mesic grassland sites at elevations of 6,800-11,000 feet, occurring in montane meadows, edges between open meadows and pine forests, and in tundra (Anderson 2006).
<i>Physaria didymocarpa</i> var. <i>lanata</i> Common Twinpod	S2	Yes	---	Occurs on red bed clay/shale slopes and sparsely vegetated grasslands and woodlands. Can also be found in limestone outcrops, road cuts and other rock cliffs at elevations from 3,600-9,600 feet (Heidel et al. 2004). Needs pollinator. Occurrence documented on the TBNG.
<i>Tritelia grandiflora</i> Largeflower Tritelia	S2	No	No habitat present in analysis area	Grassy areas in sagebrush at edge of aspen and lodgepole pine forests, also pinyon-juniper woodlands to pine forest slopes and hills at elevations of 4,600-8,000 feet (Ladyman 2007).

Species Name (Common and Scientific)	Conservation Status ¹	Suitable Habitat in the Analysis Area	Rationale for Exclusion if not Carried Forward for Analysis	Brief Habitat and Range Description
<i>Viburnum opulus</i> var. <i>Americana</i> Highbush Cranberry	S2	No	No habitat present in analysis area	Commonly found in association with paper birch on moist wooded hillsides and thickets, requires moist to damp soil, and is usually found in the vicinity of a reliable water source (Nellessen 2006b).

Bold = habitat occurs within analysis area

Information from NatureServe 2011, Haynes 2011, USFS 2011, WYNDD 2010.

¹ Status Codes: S1=critically imperiled in Wyoming, S2=imperiled in Wyoming, S3=vulnerable in Wyoming, NR=not ranked/under review in Wyoming.

Habitat evaluation indicated habitat was lacking within the analysis area for nine of the 11 species. Typical suitable habitat for two species (Barr's milkvetch and common twinpod) occurs in areas of the Bunchgrass and Rough Breaks communities as estimated in Table 16, portions of which would be incrementally affected by the Proposed Action. Species surveys were conducted within those communities for Barr's milkvetch and common twinpod, and no plants were observed in the analysis area.

Table 16: Sensitive Species Habitat Occurrence and Disturbance on NFS Lands within the Project Area

Mining Sequence (Years)	Total Barr's Milkvetch Habitat: Estimated 10% of Bunchgrass and 25% of Rough Breaks Communities (Acres)	Common Twinpod Habitat: Estimated 25% of Bunchgrass Community (Acres)	Total Area (Acres)
2015 - 2019	1	4	5
2020 - 2024	8	19	27
2025 - 2029	11	26	37
2030 - 2034	12	29	41
2035	1	2	3
Directly Affected (Disturbed/Mined) Area¹	33	80	113
Potentially Indirectly Affected (Unmined) Area¹	19	15	34
Total Area¹	52	95	147

¹ Within referenced vegetation communities
All acreages are estimated

Species of Local Concern

Species of Local Concern are tracked by Forest/Grassland within the USFS because they have been identified by forest botanists as locally rare, occurring in uncommon habitat, at risk of decline, or poorly understood in the vicinity of the forest.

Nineteen (19) plant Species of Local Concern were listed as having known or suspected (biologically or geographically) occurrences on the TBNG (Haynes 2011) as indicated in Table 17. Habitat analysis indicated habitat was lacking for 10 of the species as indicated in Table 17, while inclusions of habitat occurred in various vegetation communities for the remaining nine species as estimated in Table 18.

Table 17: Summary of Species of Local Concern Considered and Evaluated on NFS Lands within the Project Area

Species Name (Common and Scientific)	Suitable Habitat Occurrence	Species Occurrence	Brief Habitat and Range Description
<i>Adoxa moschatellina</i> Muskroot	No	N/A	Shady, moist, moss limestone cliff/edge at elevations of 4,400-8,000 feet. Needs pollinator.
<i>Alisma gramineum</i> Narrowleaf water plantain	Yes	Yes	Wetlands, marshes at elevations of 4,000-10,000 feet.
<i>Astragalus hyalinus</i> Summer milkvetch	Yes	No	Badland islands in grassland matrix. Eroded ridge tops, calcareous, zeolite, bentonite influenced soils, upper and midslope, more often on north and east aspects at elevations of 3,700-5,700 feet. Needs pollinator.
<i>Bahia dissecta</i> Ragleaf bahia	No	N/A	Streamside, big sage, ponderosa, juniper at elevations of 6,500-9,000 feet. Wind pollinated.
<i>Botrychium multifidum</i> Leathery grapefern	No	N/A	Old pasture, meadows, woodland margins, riverbanks, bottomland, riparian habitat generalist at elevations of 0-9,800 feet.
<i>Callitriche heterophylla</i> Large water-starwort	No	N/A	In kettle (shallow) ponds at elevations of 8,500-12,000 feet.
<i>Carex sartwellii</i> Sartwell's sedge	No	N/A	Temporarily flooded grasslands, saline wet meadows, marshes, northeast glaciated ponds, lakes. Clonal, wind pollinated.
<i>Chenopodium subglabrum</i> Smooth goosefoot	No	N/A	Sandy areas, particularly sand bars in rivers and in sandy blowouts near river banks at elevations of 1,000-4,600 feet.
<i>Chenopodium watsonii</i> Stinking goosefoot	Yes	No	Badlands, open steppe, disturbed prairie at elevations of 5,000-5,400 feet. Needs pollinator.
<i>Dichanthelium linearifolium</i> Slimleaf panicgrass	Yes	No	Grasslands, open woods in dry stony or sandy sites or granite outcrops at elevations of 4,700-6,600 feet. Wind dispersed, clonal.
<i>Euthamia graminifolia</i> Flat-top goldentop	No	N/A	Moist or drying sites, stream banks, roadside ditches, sand bars at 4,600-8,000 feet. Needs pollinator.
<i>Lewisia rediviva</i> Oregon bitterroot	Yes	Yes	Rabbitbrush, sparsely vegetated and rocky at elevations of 7,300-8,300 feet. Needs pollinator. Precluded by dense annual grass component.
<i>Liatris ligulistylis</i> Rocky Mountain blazing star	No	N/A	Wet hay meadows, west slope at 4,000-8,000 feet. Needs pollinator?
<i>Palafoxia rosea</i> var. <i>macrolepis</i> Rosy palafox	Yes	No	Sagebrush, Mixed Grass prairies, sandy soils at elevations of 4,100-4,860 feet. Needs pollinator.
<i>Pectis angustifolia</i> Lemonscent	Yes	No	Sandy ravines, sandbars, gravel hills, scoria outcrop red clinker at elevations of 4,000-4,800 feet. Needs pollinator.
<i>Polypodium saximontanum</i> Rocky Mountain polypody	No	N/A	Cracks and ledges on rock outcrops, apparently confined to granitic and gneiss substrates, granite rock outcrops and

Species Name (Common and Scientific)	Suitable Habitat Occurrence	Species Occurrence	Brief Habitat and Range Description
			boulders in open or shady canyons within forests at elevations of 7,600-8,700 feet.
<i>Stuckenia filiformis</i> Fineleaf pondweed	Yes	No	Calcareous ponds within wetlands at elevations of 4,000-10,000 feet.
<i>Stuckenia pectinatus</i> Sago pondweed	Yes	Yes	Calcareous shallow (kettle) ponds with chara.
<i>Toxicodendron rydbergii</i> Western poison ivy	No	N/A	Mountain shrub at elevations of 4,000-9,000 feet. Needs beetle pollinator.
<i>Xanthoparmelia neowyomingica</i> New Wyoming xanthoparmelia lichen	Yes	No	Windy areas of short grass or scrub-shrub vegetation, snow free in winter at elevations of 4,000-11,000 feet. Occurs in areas of soils interspace: precluded by dense annual grass component.

Bold = species observed

Table 18: Species of Local Concern Habitat Occurrence and Disturbance by Vegetation Community on NFS Lands within the Project Area

Mining Sequence (Years)	Narrowleaf Water Plantain, Fineleaf Pondweed, and Sago Pondweed Habitat: 5% of Wetlands (Acres)	Summer Milkvetch Habitat: 10% Bunchgrass, 25% Rough Breaks (Acres)	Stinking Goosefoot Habitat: 25% of Rough Breaks (Acres)	Slimleaf Panicgrass, Oregon Bitterroot, and Lemonscent Habitat: 25% of Bunchgrass (Acres)	New Wyoming Xanthoparmelia Lichen Habitat: 25% of Big Sagebrush and Mixed Grass Prairie (Acres)	Total Area (Acres)
2015 - 2019	---	1	0	4	11	16
2020 - 2024	---	8	1	19	5	33
2025 - 2029	---	11	0	26	3	40
2030 - 2034	0	12	1	29	27	69
2035	0	1	---	2	5	8
Directly Affected (Disturbed/Mined) Area	---	33	2	79	52	166
Potentially Indirectly Affected (Unmined) Area	0.5	19	13	15	150	198
Total Area	0.6	52	15	94	202	364

--- Does not occur.

0 = Occurs, but area is less than 0.5 acres.

Species surveys were conducted for nine species, of which two (narrowleaf water plantain and Oregon bitterroot) were observed on NFS lands within the project area. One additional species (sago pondweed) listed on the Region 2 list but not known or suspected on the TBNG was also observed.

No further analysis is required for species not known or suspected to occur in the area and for which no suitable habitat is present; therefore analysis was completed for nine TBNG listed species and one additional species.

3.6.2. Environmental Consequences

3.6.2.1. Alternative 1 – No Action

Under the No Action alternative, clinker mining would not be implemented on NFS lands within the project area. Potential would remain for clinker mining on adjacent private lands.

Direct and Indirect Effects

No direct or indirect effects from mining would occur on NFS lands under the No Action Alternative. Potential would remain for vegetation communities to be affected by mining on adjacent private lands.

Cumulative Effects

The No Action Alternative will not add to cumulative effects to species of concern. Past and present activities occurring within the project area include surface mining, livestock grazing, fence construction and maintenance, wildlife use, recreational activities, oil well drilling, and fire suppression activities. Similar activities occur in the surrounding area, with the addition of large scale surface coal mining and CBNG production. Future activities are expected to be similar in the general area with ongoing grazing and recreation activities and expansion of energy production operations.

Biological Determination

Threatened, Endangered and Proposed Species

The biological determination of the No Action Alternative is **No Effect** for Threatened and Endangered species because no blowout penstemon or Ute Ladies' Tresses orchid habitat or individuals occur within the project area.

Sensitive Species

The biological determination of the No Action Alternative is **No Impact** for Sensitive species because although suitable habitat occurs for Barr's milkvetch and common twinpod, it would not be affected under the No Action Alternative.

Species of Local Concern

The biological determination of the No Action Alternative is **No Impact**. No mining would be implemented on NFS lands and no affects would occur to existing habitat (stinking goosefoot, slimleaf panicgrass, rosy palafox, lemonscent, fineleaf pondweed, and new Wyoming xanthoparmelia) or species (narrowleaf water plantain, Oregon bitterroot, sago pondweed) as a result of mining on NFS lands within the project area.

3.6.2.2. Alternative 2 – Proposed Action

Under the Proposed Action alternative, clinker mining would be implemented on private and NFS lands within the project area.

Direct and Indirect Effects

The proposed action will result in disturbance of approximately 113 acres for Sensitive Species and 166 acres of Species of Local Concern of the total 541 acres of NFS lands within the project area will be directly affected. Indirect effects to habitat will occur in the form of dust deposition and increased potential for noxious weed introduction and spread. Approximately 34 acres for Sensitive Species and 198 acres for Species of Local Concern of the total of 541 acres of NFS lands within the project area will be indirectly affected. All disturbed lands would face an increased threat of weed establishment, and any increase in weed populations may also affect undisturbed habitats. Pollinators required by some species may be affected by disturbances within, or within flying distance of, NFS lands on the project area.

Cumulative Effects

Past and present activities within the project area include surface mining, livestock grazing, fence construction and maintenance, wildlife use, recreational activities, oil well drilling, and fire suppression activities. Similar activities occur in the surrounding area, with the addition of large scale surface coal mining and CBNG production. Future activities are expected to be similar, although livestock grazing and recreational activities would be suspended in fenced active mine or reclamation exclusion areas.

Vegetation communities would be affected in disturbance areas. Cumulative effects for species of concern include disturbance of existing unoccupied habitat or populations from various activities, increased potential for weed establishment or spread, and potential effects to pollinators required by some species.

Increased human activity may result in accelerated spread of local weed populations and may introduce new populations into the area through transport on vehicles, harvesting, or seeding (Clark 2000). Seeds can lodge in various locations on vehicles and dislodge at any time, thus dispersing to new areas. Seeds or plant parts could be moved through soil hauling, and seeds could be included in seeded mixes.

Biological determination

Threatened, Endangered and Proposed Species

A biological determination of **No Effect** was made for Threatened and Endangered species because no blowout penstemon or Ute Ladies' Tresses orchid habitat or species occur within the project area.

Sensitive Species

A biological determination of **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area nor cause a trend toward federal listing** was made for two sensitive species (Barr's milkvetch and common twinpod) because suitable habitat may be affected but no known individuals will be impacted by the Proposed Action.

Species of Local Concern

A biological determination of **may adversely impact habitat or individuals, but is not likely to result in a loss of viability in the planning area nor cause a trend toward**

federal listing was made for Species of Local Concern under the Proposed Action. Listed species for which habitat and/or species may be affected within the analysis area consist of narrowleaf water plantain (species observed), stinking goosefoot, slimleaf panicgrass, Oregon bitterroot (species observed), rosy palafox, lemonscent, fineleaf pondweed, sago pondweed (species observed), and new Wyoming xanthoparmelia.

Surface disturbance and potential for noxious and invasive weed establishment would affect suitable habitat and species occurrence under the Proposed Action Alternative. No loss of viability is determined because known populations will not be impacted by the Proposed Action, or because impacted individuals and habitats represent a tiny fraction of known populations and distribution on the TBNG.

Mitigation

Reclamation would occur on mined out areas as new areas are disturbed. Reclamation practices have been widely employed in the PRB in response to various mining activities and are required to meet or exceed performance standards identified by the Surface Mining Control and Reclamation Act (SMCRA) of 1977 with oversight and enforcement by the US Department of Interior Office of Surface Mining and the WDEQ-LQD. SMCRA requires restoration of the land affected to a condition capable of supporting the uses which it was capable of supporting prior to any mining, or higher or better uses of which there is a reasonable likelihood.

Re-vegetation would be addressed through soils handling and preparation as well as use of seed mixtures approved by the USFS and WDEQ, as appropriate. Shrubland and grassland re-establishment is ongoing in the PRB. Monitoring is utilized to track vegetation re-establishment after seeding.

Schuman (2002) determined that sagebrush seedling size was 2-4 times greater at grass seedling rates of ≤ 6 kg pls/ha, likely affecting sagebrush seedling survival. Sagebrush survival was found to be 59% after eight years on reclaimed mineland in northeast Wyoming (Schuman and Belden 2002) and expected to meet reclamation standards 10 years after reseeding.

Stahl et. al (2009) determined during studies on surface mines in northeastern Wyoming that plant community composition differed over time due to vegetation succession. Newly reclaimed communities consisted mostly of annual forbs with no shrubs present. Five-year old sites exhibited a high shrub density and native cool season grasses. The 10-year old site supported perennial forbs and warm season grasses, and the shrub density had started to decline. The 16-year old site was dominated by native cool season grasses and had a lower shrub density than the 10-year old site. Environmental conditions at the research sites addressed by this study were identified as appearing to be returning to those present at nearby undisturbed sites.

Irreversible and Irretrievable Commitments of Resources

No irreversible impacts to vegetation are expected from the Proposed Action Alternative. Irretrievable commitments would occur as:

- 113 acres of potential Sensitive Species habitat directly affected;

- 34 acres of potential Sensitive Species habitat indirectly affected;
- 166 acres of potential Species of Local Concern habitat directly affected; and
- 198 acres of potential Species of Local Concern habitat indirectly affected.

3.7. Wetlands

3.7.1. Affected Environment

Wetlands are surface features defined as “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation adapted for life in saturated conditions. Wetlands generally include swamps, marshes, bogs, and similar areas” (33 CFR 328.3[a][7][b]).

As defined in Novitzki (1997), wetlands are important for the various functions they perform, including water storage, transformation of nutrients, growth of living matter, and diversity of wetland plants. Functions can be broadly grouped as habitat, hydrologic, and water quality. Habitat is defined as the part of the physical environment in which plants and animals live, and wetlands are considered among the most productive habitats in the world. Wetlands function to provide food, water, and shelter for fish, shellfish, birds, and mammals, and serve as a breeding ground and nursery for numerous species. Many endangered plant and animal species are dependent on wetland habitats for their survival. Hydrologic functions are those related to the quantity of water that enters, is stored in, or leaves a wetland. These functions include such factors as the reduction of flow velocity, the role of wetlands as groundwater recharge or discharge areas, and the influence of wetlands on atmospheric processes. Water quality functions include sediment trapping, pollution control, and the biochemical processes that take place as water enters, is stored in, or leaves a wetland.

Wetlands must meet criteria for three parameters consisting of hydric soils, hydrophytic vegetation, and wetland hydrology. Hydric soils form under specific conditions in which water inundation or saturation of the upper soil profile during the growing season (defined by appropriate soil temperature) is sufficient to create conditions in which soil organisms consume the available oxygen, thereby causing conditions unsuitable for growth of most plants. This process creates visual “hydric soil” indicators including a specific range of colors or color combinations. Hydrophytic vegetation is the sum total of plant life that occurs in areas where the frequency and duration of soil saturation or inundation exerts a controlling influence on the plant species present. Wetland hydrology encompasses all hydrologic characteristics of the area that are periodically inundated or have soils saturated to the surface at some time during the growing season. Visual indicators of all three parameters are analyzed in the wetland delineation process completed per the U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual (Environmental Laboratory 1987) and the applicable Regional Supplement to the Wetlands Delineation Manual. The Great Plains Regional Supplement (Environmental Laboratory 2010) is applicable to the project area.

Waters of the U.S. (WoUS) is a collective term for those water bodies subject to regulation pursuant to the Clean Water Act (CWA) that includes wetland and Other

(nonwetland) Waters of the US (OWUS). WoUS incorporate deepwater habitats and special aquatic sites, of which wetlands is a subset. The definition of WoUS has been broadly interpreted to include most major water bodies, streams, intermittent drainages, mud flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, and natural ponds. Special aquatic sites are defined as “geographic areas, large or small, possessing special ecological characteristics and productivity, habitat, wildlife protection, or other important and easily disrupted ecological values” (40 CFR 230.3[Q-1]) and include “sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes” (40 CFR 230, Subpart E).

The USACE administers a regulatory program under Section 404 of the CWA that regulates dredging and filling activities in WoUS over which the agency has jurisdiction. Wetlands and OWUS subject to CWA jurisdiction are known as “jurisdictional” while those not subject to jurisdiction are known as “non-jurisdictional”. Areas meeting only one or two of the three wetland parameters are often referred to as “functional” wetlands and are not subject to regulation by the USACE. Rules, regulations, policies and procedures used in determining the extent of jurisdiction have changed over time. Jurisdictional wetlands and OWUS must meet complex criteria related to relatively permanent and traditional navigable waters as further defined in 33 CFR 328 or otherwise administered by the USACE who is tasked with ensuring that current and pertinent regulatory needs are met during the jurisdictional determination process.

Under the USACE regulatory program, an inventory of wetlands and OWUS must be performed for jurisdictional consideration if a proposed project has the potential to affect wetlands or OWUS. Permits must be acquired prior to dredging or filling of jurisdictional features, and compliance with the regulatory program requires a sequence of avoidance, minimization of impact, and mitigation.

Executive Order No. 11990, Protection of Wetlands, (EO11990 1977) provides direction to Federal agencies for protection of wetlands on Federal lands. USACE requirements need to be met as part of the WDEQ-LQD Permit to Mine process, which must be completed prior to initiation of mining activity. WDEQ-LQD regulations may require re-establishment of non-jurisdictional or functional wetland features within the permit area during the reclamation process to restore high value wildlife habitat. Sediment control measures are also required by the permit to mine for prevention of off-site sediment migration and other potential effects to the integrity and function of wetlands and OWUS from mining activities.

A total of 541 acres of NFS lands and 481 acres of private lands is proposed for mining within the project area. The area is dominated by uplands generally characterized as rolling hills with areas of scoria outcrop bisected by ephemeral drainages. Most associated drainages occur above the confluence of Little Thunder Creek and North Prong Little Thunder Creek.

Existing project area information was reviewed. National Wetland Inventory (NWI) mapping (USFWS 2010), consisting of aerial photo interpretation of functional wetland occurrences with limited or no field verification, indicated wetlands in one reservoir located on an unnamed dry ephemeral channel and one reservoir located on Burning Coal

Draw. National Agriculture Imagery Program (NAIP) (USDA FSA 2009) orthophoto and University of Wyoming color infra-red (UW 2001) imagery indicated additional likely wetland occurrences along the reaches of Burning Coal Draw and North Prong Little Thunder Creek. WDEQ-Water Quality Division stream classification tables (WDEQ-WQD 2001) classify North Prong Little Thunder Creek and all tributaries (including Burning Coal Draw) occurring above the confluence of Little Thunder Creek and North Prong Little Thunder Creek as ephemeral.

Visual field verification and mapping of maximum potential wetland (jurisdictional, non-jurisdictional, or functional) and OWUS boundaries was conducted August 23-29, 2010. Wetlands occurred in a variety of forms but were of limited size and distribution, generally created by ponding in response to precipitation events or snowmelt. Seasonal water level fluctuations were indicated by bare ground adjacent to surface water, the upper extent of which identified the ordinary high water mark. A playa and one unnamed ephemeral channel system supported temporarily flooded depressional area wetlands dominated by foxtail barley (*Hordeum jubatum*), creeping spikerush (*Eleocharis palustris*) and least spikerush (*Eleocharis acicularis*). One semi-permanently flooded reservoir on a dry ephemeral drainage supported open water wetlands (plants growing below the surface of the water) bounded by a fringe of creeping spikerush and foxtail barley. A second reservoir in Burning Coal Draw also supported similar open water wetlands but was bounded by prairie cordgrass (*Spartina pectinata*). The reaches of Burning Coal Draw and North Prong Little Thunder Creek drainages also supported periodically inundated channel bottoms with a fringe of dense prairie cordgrass.

Hydrology along Burning Coal Draw and Little Thunder Creek is affected by upchannel mining operations and associated water management systems. Water discharge from mining areas is managed through use of reservoirs located above the project area that restrict native channel through-flow. Water discharge from these reservoirs occurs infrequently on an as-needed basis in response to significant precipitation or snowmelt events.

The project area supports a preliminary total of 41.88 acres of wetlands comprised of 5.07 acres on NFS lands and 36.81 acres on private lands. Wetland results for NFS lands are presented in Table 19 and locations are illustrated in Figure 7, while results for private lands are summarized in Table 20. Wetland features are classified within the Cowardin system (Cowardin et al. 1979) as:

- Palustrine emergent (PEM) marsh and wet meadow wetlands, and
- Palustrine aquatic bed (PAB) wetlands.

NFS lands within the project area support 5.07 acres of wetlands comprised of 4.22 acres of PEM wetlands and 0.85 acres of PAB wetlands. A total of 0.81 acres of wetlands occurring in two features located on NFS lands would be affected by the proposed mining sequence. The 0.81 acres of wetlands are located in one playa and one unnamed (dry) channel reservoir providing a total of 0.71 acres of PEM wetlands and 0.10 PAB acres as summarized in Table 19.

Private lands within the project area support approximately 36.81 acres of wetlands comprised of 29.49 PEM acres and 7.32 PAB acres along Burning Coal Draw, North

Prong Little Thunder Creek, and Little Thunder Creek as well as in one reservoir on a dry ephemeral drainage. No wetlands occurring on private lands would be affected by the proposed mining sequence as summarized in Table 20.

Table 19: Preliminary Wetlands Inventory Summary for NFS Lands

Area Identification	PEM ¹ Wetlands (Acres)	PAB ² Wetlands (Acres)	Total Wetlands (Acres)	Proposed Affected (No/Yes: year)
Unnamed Channel Wetlands	0.15	---	0.15	No
Unnamed Channel Reservoir	0.56	0.10	0.66	Yes: 2035
Playa	0.15	---	0.15	Yes: 2030-2034
Burning Coal Draw and Reservoir	2.77	0.62	3.39	No
North Prong Little Thunder Creek	0.59	0.13	0.72	No
Total NFS Wetlands:	4.22	0.85	5.07	---
Total NFS Wetlands Affected (Disturbed):	0.71	0.10	0.81	---

¹Palustrine emergent (wet meadow or temporarily flooded marsh)

²Palustrine aquatic bed (seasonally or semi-permanently flooded)

Table 20: Preliminary Wetlands Inventory Summary for Private Lands

Area Identification	PEM ¹ Wetlands (Acres)	PAB ² Wetlands (Acres)	Total Wetlands (Acres)	Proposed Affected (Yes/No)
Unnamed Channel Reservoir	0.19	0.03	0.22	No
Burning Coal Draw	0.98	0.04	1.02	No
Little Thunder Creek	1.78	0.85	2.63	No
North Prong Little Thunder Creek	26.54	6.40	32.94	No
Total Private Wetlands:	29.49	7.32	36.81	---
Total Private Wetlands Disturbed:	0.00	0.00	0.00	---

¹Palustrine emergent (wet meadow or temporarily flooded marsh)

²Palustrine aquatic bed (seasonally or semi-permanently flooded)

Jurisdictional status of project area wetlands or OWUS is not discussed in this document because only the USACE has the authority to make a jurisdictional determination. However, the USACE has completed non-jurisdictional determinations for wetlands or OWUS within the nearby TBCC permit boundaries (USACE 2011) that include up-channel reaches of Burning Coal Draw and North Prong Little Thunder Creek. Project area USACE requirements would be addressed during the mine permitting process.

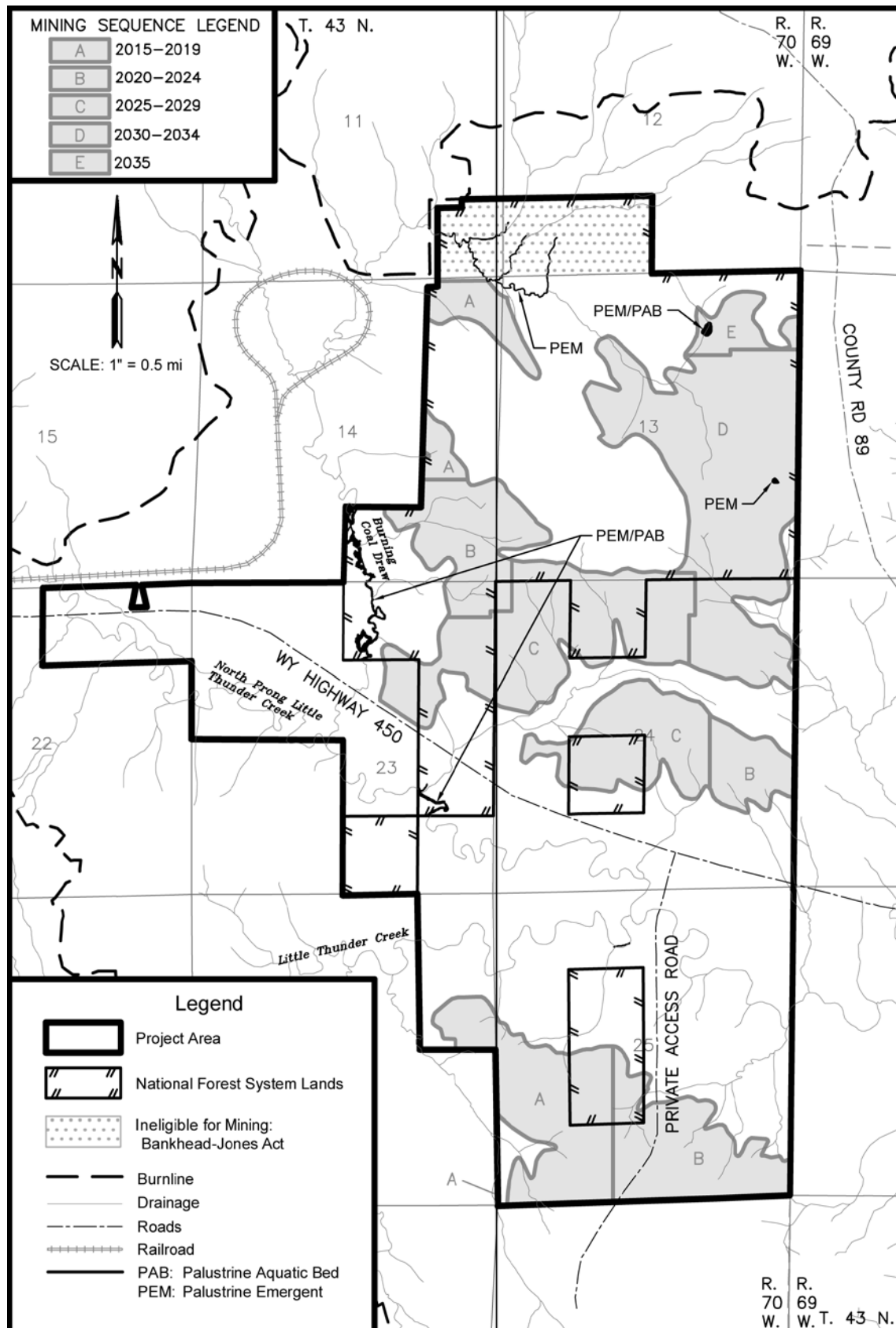


Figure 7: NFS Lands Wetland Summary

3.7.2. Environmental Consequences

3.7.2.1. Alternative 1 – No Action

Direct and Indirect Effects

Under the No-Action Alternative, no clinker mining would occur within the analysis area and no impacts to wetlands would occur. Natural processes and climate cycles would continue to influence wetlands and OWUS. Any potential affects to wetlands as a result of grazing, fencing, recreation, and wildlife use would continue. Mining and associated grazing exclusion in adjacent areas may influence wetlands. A change in grazing management may result in increased vegetation trampling and hydrologic changes in wetland areas adjacent to exclusion areas.

The No-Action Alternative is consistent with Grassland Plan directive to conserve moisture and protect long-term stream health from damage by runoff, as well as to maintain or improve long-term health of water influence zones next to wetlands or water bodies.

Cumulative Effects

Although no wetlands would be affected within the analysis area under the No-Action Alternative, wetlands have been affected by mining processes in the past, and future mining has the potential to further affect area wetlands. Potential effects from up-channel mining and reclamation activity would continue. Wetland features and/or function would be restored to the extent possible during the reclamation process as determined by USACE and WDEQ-LQD project oversight. Other current activities would also occur but would not be expected to significantly affect wetlands.

3.7.2.2. Alternative 2 – Proposed Action

Direct and Indirect Effects

A total of 0.81 acres of potential wetlands on NFS lands would be disturbed by the proposed mining sequence under Alternative 2. The wetlands occur in the form of one playa and one reservoir located on a dry ephemeral drainage. Wetlands would be avoided or reclaimed as approved during the mine permitting process.

No wetlands occurring on private lands would be disturbed.

Potential also occurs for some undisturbed wetlands to be excluded from grazing or recreational use while active mine or reclamation areas are fenced for the purposes of public safety and mining efficiency.

Cumulative Effects

Under Alternative 2, potential wetland disturbances would increase as a result of the Proposed Action as well as historic and expected future mining activities. Potential effects from up-channel mining and reclamation activity would continue. Wetland features and/or function would be restored over time during the reclamation process as determined by USACE and WDEQ-LQD project oversight. Other current activities

would be expected to continue but would not be expected to significantly affect wetlands. Effects on wetland resources are expected to be slightly higher under the Proposed Action than under the No-Action Alternative.

Irreversible and Irretrievable Commitments of Resources

No irreversible impacts to wetlands are expected from the Proposed Action Alternative. An irretrievable commitment would occur as 0.81 acres of wetlands until replaced.

3.8. Wildlife and Aquatics

3.8.1. Affected Environment

A Biological Assessment and Evaluation was conducted for federally listed species, USFS Region 2 (R2) species of concern, Management Indicator Species (MIS), and other wildlife species and habitat that potentially occur within the project area.

The landscape of the analysis area is an upland site dominated by a mosaic of grassland and big sagebrush communities. Bluebunch wheatgrass is predominant on steep slopes and hilltops with shallow soils. Big sagebrush and other grasses are more predominant on the level plains and gentle slopes with deeper soils.

The dominant vegetation includes numerous grass species on the more level plains, with a mixture of big sagebrush and grass species in more hilly locations. The landscape is generally open with only one small isolated area of ponderosa pine and juniper hills. Little Thunder Creek and North Prong Little Thunder Creek cross the southern portion of the area. However, these creeks are ephemeral and are generally dry in the summer and fall. A few plains cottonwoods are present along Little Thunder Creek.

The grass communities in mid to late seral stages are dominated by native grass species of western wheatgrass, needle and thread grass, prairie June grass, and bluebunch wheatgrass. In grass-dominated communities, there is more big sagebrush in the mid to late seral stages than in early to mid seral stages. As the community moves from early to late seral stage, the percentage of grasses declines. In the shrub understory, the dominant native plant species are western wheatgrass, needle and thread, prairie June grass, and blue grama.

Biological Assessment for Endangered, Threatened, Proposed, and Candidate Species

The biological assessment considers the potential environmental effects of the proposed action on Federally Endangered, Threatened, Proposed, and Candidate Species. Specific species and habitats were identified in cooperation with the U.S. Fish and Wildlife Service (USFWS).

- **Endangered:** An animal or plant in danger of extinction within the foreseeable future throughout all or a significant portion of its range is classified as endangered.

- Threatened: Threatened species are animal or plant species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
- Proposed: A proposed species is any species of animal or plant that is proposed in the Federal Register to be listed under Section 4 of the Endangered Species Act.
- Candidate: A species for which the USFWS has sufficient information on their biological status and threats to propose them as endangered or threatened, but for which development of a proposed listing regulation is precluded by other higher priority listing activities.

The black-footed ferret and Greater Sage-Grouse are the only wildlife species currently on the list of endangered, threatened proposed, or candidate species with habitat in the project area. Prairie dog colonies are the requisite habitat for this species. Black-tailed prairie dog colonies are found scattered throughout much of the TBNG and are present on lands within the project area. In a memorandum dated February 2, 2004 (USFWS 2004) the USFWS determined that black-footed ferret surveys were no longer required in black-tailed prairie dog colonies in Wyoming. This clearance reflects the negligible likelihood that a wild population of black-footed ferrets occurs in the project area.

Due to major shifts in land use, sagebrush landscapes have gone through significant changes over the past 200 years. Much of the sagebrush ecosystem depended upon by many wildlife species has been lost, fragmented, or degraded due to human land uses, changes in fire regimes, and the pervasiveness of invasive plants (Knick *et al.* 2003). Consequently, Greater Sage-Grouse have experienced long-term range-wide population declines to the point that they currently only occupy half of their historic distribution (Schroeder *et al.* 2004). On March 23, 2012 the USFWS determined that the Greater Sage-Grouse were warranted for protection under the Endangered Species Act of 1973; however, due to other higher priority actions, they were precluded from listing and the Greater Sage-Grouse became a Candidate species. Subsequently, a court-approved settlement agreement between the USFWS and environmental groups was established which set a schedule for making listing determinations for over 200 candidate species, including the Greater Sage-Grouse by September 2015.

Over the past 200 years changes in fire regime have occurred across the range of the Greater Sage-Grouse due to shifting land uses and fire management practices. Subsequently, fire-return intervals have been reduced and, in combination with the inability of sage-brush steppe plant communities to recover rapidly from fire, invasion of sagebrush habitat by annual grasses due to fire or other disturbance may result in the conversion of disturbed sagebrush areas into unsuitable habitat for Greater Sage-Grouse (Johnson *et al.* 2011).

Currently, cheatgrass exists throughout much of the western United States (Meinke *et al.* 2009). The presence of cheatgrass in a sagebrush community creates a cascading feedback loop toward cheatgrass dominance through increased fire disturbance, loss of perennial natives and their seed banks, and decreased stability and resilience to short-term weather events and long-term climate changes (Chambers *et al.* 2007, Miller *et al.* 2011).

Greater Sage-Grouse populations and sagebrush habitats are increasingly exposed to human activities. Relatively low levels of anthropogenic activity and features on the landscape surrounding sage grouse leks create cumulative effects associated with decreasing sage grouse population trends (Johnson 2011).

Sustainable Greater Sage-Grouse populations require large landscapes; thus even slight fragmentation from somewhat dispersed disturbances may lead to population declines and regional extinctions. Interstate, federal, and state highways are associated with lower lek count trends when within 18 km of leks. Leks that have persisted near highways may be positioned where topography has isolated these disturbances. As traffic associated with energy development increases with growing energy development, within Greater Sage-Grouse habitat, greater disturbances and fragmentation occur (Johnson 2011).

Presence of uniformly distributed vertical structures (i.e. communication towers, transmission lines, wind turbines) has been negatively correlated with lek counts. Some of these vertical structures can be used as perches by avian predators and thus may be avoided by Greater Sage-Grouse and, on occasion, Greater Sage-Grouse can collide with such structures in flight. However, this negative association with vertical structures may be compounded by the human presence and traffic associated with such structures as well as their proximity to developed areas (Johnson 2011).

Analysis for the Greater Sage-Grouse is covered in the Biological Evaluation and Management Indicator Species sections below.

Management Indicator Species (MIS)

As a part of the development of the Grassland Plan, Management Indicator Species (MIS) were identified. MIS are those species that indicate habitat suitability for other species with similar habitat needs. MIS are defined as “Any species, group of species, or species habitat element selected to focus management attention for the purpose of resource production, population recovery, maintenance of population viability, or ecosystem diversity” (USFS 1991). The Grassland Plan MIS identified for the project area is the Greater Sage-Grouse.

Biological Evaluation for Region 2 Sensitive Species

Species considered in this section are those identified by the Region 2 Forester as Sensitive. Species are classified as Sensitive when they meet one or more of the following three criteria: Table 21 lists each species of concern, documented status within the general analysis areas, and rationale for the analysis.

- 1) The species is declining in numbers or occurrences, and evidence indicates it could be proposed for Federal listing as threatened or endangered if action is not taken to reverse or stop the downward trend.
- 2) The species habitat is declining, and continued loss could result in population declines that lead to Federal listing as threatened or endangered if action is not taken to reverse or stop the decline.
- 3) The species population or habitat is stable but limited. In addition to the above criteria, a ranking system is used to identify species for Sensitive status, which is outlined in Forest Service Manual 2670 - 2671.

Table 21: Status and Habitat Suitability within the General Analysis Area for USFS Region 2 Sensitive Wildlife Species Identified for the TBNG *

Common Name	Scientific Name	Documented on Lands within General Analysis Area	Analysis Rationale
FISH			
Mountain sucker	<i>Catostomus platyrhynchus</i>	No	Not analyzed, unsuitable habitat on analysis area
Lake chub	<i>Couesius plumbeus</i>	No	Not analyzed, unsuitable habitat on analysis area
Plains minnow	<i>Hybognathus placitus</i>	No	Analyzed, documented downstream
Sturgeon chub	<i>Macrhybopsis gelida</i>	No	Not analyzed, unsuitable habitat on analysis area
Finescale dace	<i>Phoxinus neogaeus</i>	No	Analyzed, documented downstream
Flathead chub	<i>Platygobio gracilis</i>	No	Analyzed, documented downstream
AMPHIBIANS and REPTILES			
Northern leopard frog	<i>Lithobates pipiens</i>	Yes	Analyzed, habitat on site
Black Hills redbelly snake	<i>Storeria occipitomaculata pahasapae</i>	No	Not analyzed, unsuitable habitat on analysis area
MAMMALS			
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>	No	Analyzed, potential foraging habitat present on analysis area
Black-tailed prairie dog	<i>Cynomys ludovicianus</i>	Yes	Analyzed, habitat on site
Spotted bat	<i>Euderma maculatum</i>	No	Analyzed, potential foraging habitat present on analysis area
Hoary bat	<i>Lasiurus cinereus</i>	Yes	Analyzed, potential habitat present on analysis area
Fringed myotis	<i>Myotis thysanodes</i>	Yes	Analyzed, potential foraging habitat present on analysis area
Swift fox	<i>Vulpes velox</i>	No	Analyzed, potential habitat present on analysis area
BIRDS			
Northern goshawk	<i>Accipiter gentilis</i>	No	Not analyzed, dismissed by USFS, no habitat on project area
Grasshopper sparrow	<i>Ammodramus savannarum</i>	Yes	Analyzed, habitat on site
Sage sparrow	<i>Amphispiza belli</i>	No	Analyzed, potential habitat present on analysis area
Short-eared owl	<i>Asio flammeus</i>	Yes	Analyzed, habitat on site
American Bittern	<i>Botaurus lentiginosus</i>	No	Not analyzed, unsuitable habitat on analysis area

Burrowing owl	<i>Athene cunicularia</i>	Yes	Analyzed, habitat on site
Common Name	Scientific Name	Documented on Lands within General Analysis Area	Analysis Rationale
Ferruginous hawk	<i>Buteo regalis</i>	Yes	Analyzed, habitat on site
McCown's longspur	<i>Calcarius mccownii</i>	Yes	Analyzed, habitat on site
Chestnut-collared longspur	<i>Calcarius ornatus</i>	Yes	Analyzed, habitat on site
Greater sage-grouse	<i>Centrocercus urophasianus</i>	Yes	Analyzed, habitat on site
Mountain plover	<i>Charadrius montanus</i>	Yes	Analyzed, habitat on site
Black tern	<i>Chlidonias niger</i>	No	Not analyzed, dismissed by USFS
Northern harrier	<i>Circus cyaneus</i>	Yes	Analyzed, habitat on site
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	No	Not analyzed, dismissed by USFS
Trumpeter Swan	<i>Cygnus buccinator</i>	Yes	Not analyzed, dismissed by USFS
American peregrine falcon	<i>Falco peregrinus anatum</i>	No	Not analyzed, dismissed by USFS, no habitat on project area
Bald eagle	<i>Haliaeetus leucocephalus</i>	Yes	Analyzed, habitat on site
Loggerhead shrike	<i>Lanius ludovicianus</i>	Yes	Analyzed, habitat on site
Lewis's woodpecker	<i>Melanerpes lewis</i>	No	Not analyzed, dismissed by USFS
Long-billed curlew	<i>Numenius americanus</i>	No	Analyzed, potential habitat present on analysis area
Brewer's sparrow	<i>Spizella breweri</i>	Yes	Analyzed, habitat on site

* List based on USFS Region 2 List with effective date of May 25, 2011 and approval date of June 10, 2011.

Sensitive Species

The **plains minnow, flathead chub, and finescale dace** are known to occur in Little Thunder Creek downstream from the project area. These species could migrate to the project area during peak discharges from reservoirs located upstream. In addition, they may be present on the project area during spring runoff or after intense thunderstorms when they migrate or are washed downstream from upstream habitats.

Habitat (both aquatic and adjacent upland type) for the **Northern leopard frog** is present on the project area, and this species has been observed.

Several currently active **black-tailed prairie dog** colonies exist within the project area.

Foraging habitat for the **Townsend's big-eared bat** is present within the project area. However, roosting sites of caves, abandoned underground mines or abandoned buildings are not present in the area. This species has been documented within the TBNG but has not been documented on the project area.

The project area generally lacks good suitable roosting habitat for the **spotted bat** but foraging habitat is present. Spotted bats have not been documented on the project area. Temporary roosting sites may be inadvertently constructed due to mining activities by creating cracks and crevices in mine high walls.

The **hoary bat** has been documented by the USFS in the general area. Suitable habitat for the Hoary bat on the project area consists of some deciduous trees along Little Thunder Creek that may provide roosting sites. The project area also contains foraging habitat for this bat species.

Limited suitable habitat for the **fringed myotis** exists on the project area. This species has been recorded by the USFS in the general area. Roosting habitats such as caves, mine tunnels and buildings are not present on the project area.

Swift fox have been observed at various locations and times several miles west of the project area, but has not been observed on the project area.

The **grasshopper sparrow** has been documented on the project area. There is suitable habitat for this species that consists primarily of grasslands.

The **sage sparrow** has not been documented on the project area but suitable big sagebrush habitat is present.

Habitat for the **short-eared owl** ranges from suitable (grasslands) to unsuitable (dense shrublands) on the project area. This species has been documented on the project area.

Potential nesting habitat for the **burrowing owl** is largely limited to the black-tailed prairie dog colonies located in the project area.

There is only one known **ferruginous hawk** nest site currently intact within one mile of the project area. This nest site has been actively tended only once (2001) since 1996, and has been inactive all of the other years since 1996.

McCown's and Chestnut-collared longspurs have been documented in limited numbers on the project area.

Only one known observation of the **mountain plover** has been documented for this area.

NFS lands in the project area include habitats that are suitable for nesting and foraging **northern harriers**.

No **bald eagle** nests are currently present on or within one mile of the project area. Bald eagle winter roost sites are absent from project area and only a small amount of potential nesting or roosting habitat is present.

Loggerhead shrikes are occasionally observed on and adjacent to NFS lands within the project area. No actual shrike nests or recently fledged young have been documented on or near NFS lands in the project area, but this species most likely nest in the area. Most sightings have occurred in cottonwood-riparian corridors along Little Thunder Creek, big sagebrush shrubland, and greasewood stands. The loggerhead shrike has also been recorded perched on fences and overhead power lines at the adjacent coal mines. Loggerhead shrike foraging habitat is present throughout the project area.

There have been very limited sightings of **long-billed curlews** in the project area over the last 30 years, and the fact that habitat conditions in those areas are only suitable for foraging migrants or non-breeding adults.

No nests have been encountered in the general analysis area, the presence and behavior (singing) of birds throughout spring and summer suggest that **Brewer's sparrows** nest in the sagebrush stands present on this area.

Species of Local Concern

Other species of concern include the Level 1 Priority Bird Species as identified by the Wyoming Partners in Flight (Nicholoff 2003), and the USFWS Birds of Conservation Concern for Bird Conservation Region #17, Badlands and Prairies (USFWS 2008). These species and their habitats have been determined to be most in need of conservation in the region. Species that may occur on the TBNG but which are outside of any effects of the proposed action (geographically or biologically) were eliminated from further review.

3.8.2. Environmental Consequences

3.8.2.1. Alternative 1 – No Action

Direct and Indirect Effects

Under the No Action alternative, clinker mining would not be implemented on NFS lands within the project area, but the potential for clinker mining on adjacent private lands would remain. Wildlife on NFS lands could be disturbed or displaced under the No Action alternative due to noise, human presence, activity, and traffic from clinker mining on adjacent private lands.

Cumulative Effects

The No Action alternative could have cumulative effects on wildlife on NFS lands in the project area primarily due to clinker mining on adjacent private lands. Past and present activities occurring within the project area include surface mining, livestock grazing, fence construction and maintenance, wildlife use, recreational activities, oil well drilling,

and fire suppression activities. Similar activities occur in the surrounding area, with the addition of large scale surface coal mining and CBNG production. Future activities are expected to be similar in the general area with ongoing grazing and recreation activities and expansion of energy production operations.

3.8.2.2. Alternative 2 – Proposed Action

Under the Proposed Action alternative, clinker mining would occur incrementally on NFS and private lands. Mined out areas would be reclaimed as new areas are disturbed.

Direct, Indirect, and Cumulative Effects

Threatened, Endangered, Proposed, and Candidate Species

Direct Effects

Implementation of the Proposed Action alternative may impact localized, foraging, transient, or migrating individuals on NFS lands as clinker mining is conducted on adjacent private lands. A biological evaluation of may impact individuals, but is not likely to result in a loss of viability in the planning unit, nor cause a trend toward Federal listing was made for the Greater Sage-Grouse Candidate species. .

Since **black-footed ferret** clearance has been approved for this area, there are no expected direct or indirect effects on this species. Potential habitat in the form of black-tailed prairie dog towns may be affected but this should not impact ferrets since they do not occur in the area.

Cumulative Effects

There should not be any cumulative effects on **black-footed ferrets** because they are not present in the area. The proposed action will not conflict with the current Grassland Plan and future objectives to manage the area in regards to the black-footed ferret.

Greater Sage-Grouse may be expected on the project area as an uncommon forager and possibly for nesting in suitable habitat. Due to the consistently low number of Greater Sage-Grouse documented during wildlife surveys completed in the general area over the past 30 years, leasing and mining NFS lands and adjacent lands within the general analysis area would have limited effects on sage-grouse individuals, despite the presence of apparently suitable habitat.

Management Indicator Species

Direct Effects

The **Greater Sage-Grouse** is the listed MIS species and was also evaluated as a Sensitive species. One previously documented Greater Sage-Grouse lek, the Drill Hole lek, is located about two miles north of the project area. Since 1995, the Drill Hole lek has only been active during 2006 and 2007, where the peak male count (4) occurred in 2006, although this lek has been surveyed every year since 2007. No sage-grouse leks have been documented on the project area. No new leks were found during specific lek searches conducted on the area in 2011 and 2012. No leks were found on this area during baseline wildlife inventories or annual wildlife monitoring conducted on this site as part

of the adjacent mine permitting requirements. One Greater Sage-Grouse was observed on the project area along the northern boundary adjacent to mine reclamation during field surveys completed in 2011. No Greater Sage-Grouse were observed during the 2012 surveys.

Greater Sage-Grouse may be expected on the project area as an uncommon forager and possibly for nesting in suitable habitat. Due to the consistently low number of sage-grouse documented during wildlife surveys completed in the general area over the past 30 years, leasing and mining NFS lands and adjacent lands within the general analysis area would have limited effects on sage-grouse individuals, despite the presence of apparently suitable habitat. Potential impacts on sage-grouse that might inhabit the area, as well as on sage-grouse habitat include: alteration of plant and animal communities; loss or degradation of seasonal habitats; increased human activity and noise which could cause animals to avoid the area and/or reduce their breeding efficiency; increased road traffic and related injuries or mortalities; increased risk of predation from raptors perched on power poles and sage-grouse avoidance of areas with overhead power lines; potential illegal harvest; and reduced water tables resulting in the loss of herbaceous vegetation.

Below Table 22 shows the estimated minimum Greater Sage-Grouse population for the Thunder Basin National Grassland from 1998 to 2012.

Table 22: 2012 Estimated Minimum Greater Sage -Grouse Population for TBNG

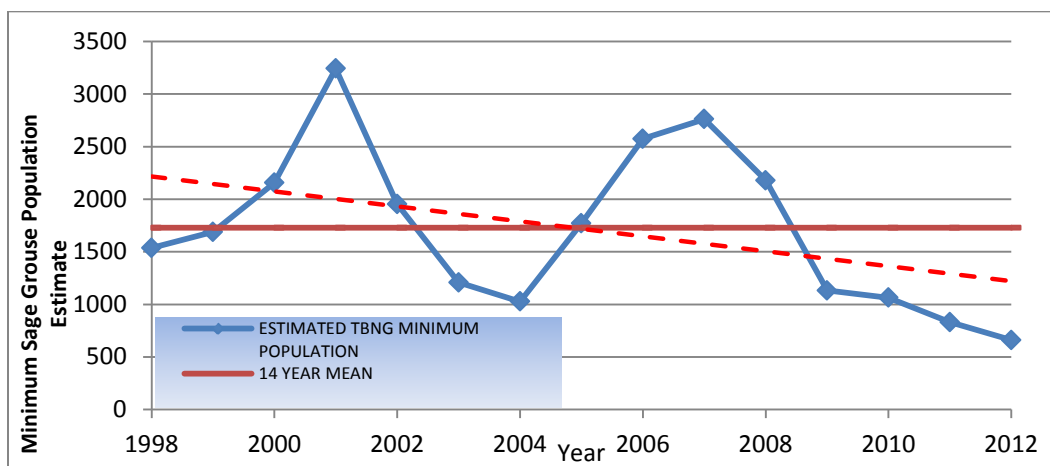


Table 23: 2012 Maximum Sage Grouse lek Attendance for Wyoming, Northeast Wyoming and Thunder Basin National Grassland

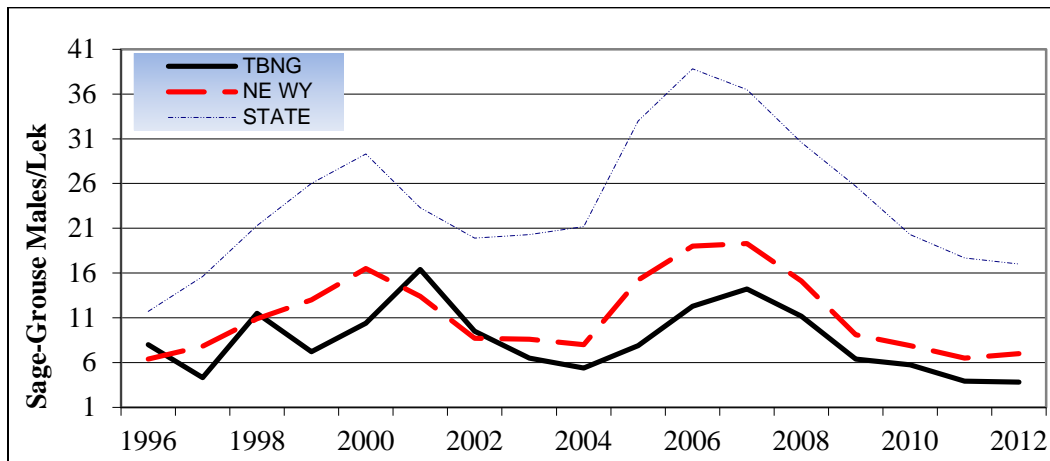
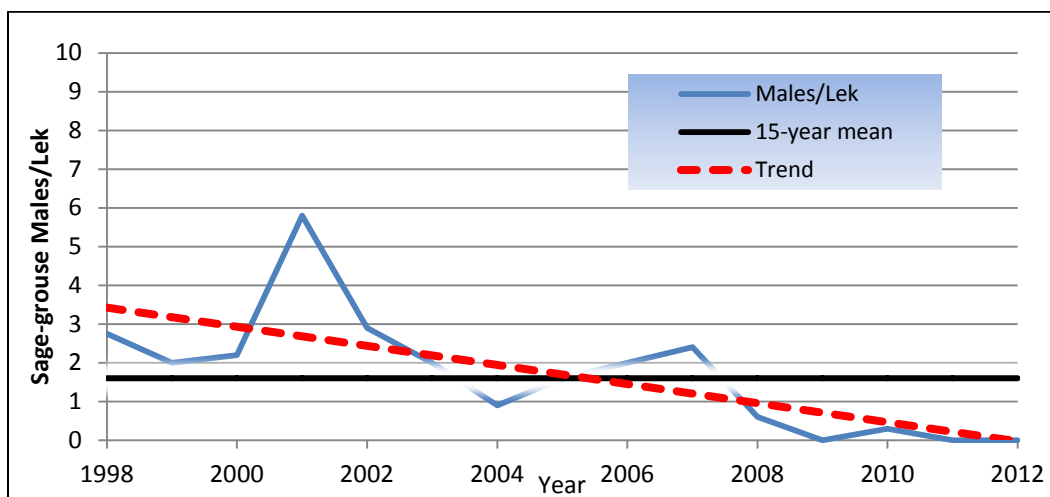


Table 24: Sage Grouse Males per lek for the Hilight Bill Geographic Area



Following reclamation, there may be a long term loss of nesting and winter habitat, depending on the amount of big sagebrush that is restored relative to the amount of sagebrush that is present before mining. New disturbances in the project area will be reclaimed incrementally, but they may not be attractive to Greater Sage-Grouse for many years due to slow establishment and growth rates of important sagebrush species.

Cumulative Effects

The TBNG has a large amount of general sage-grouse habitat areas. As such it is important to the USFS to carefully consider impacts to Greater Sage-Grouse on all of the lands the USFS manages within the TBNG. The project area does not fall within a Core Area as defined by the Governor's Executive Order 2011-5, but it is located about five to six miles west of the Thunder Basin Core Area and has the potential to impact Greater Sage-Grouse habitat. USFS regulations require analysis of impacts to MIS, both populations and habitat, regardless of the Core Area designation.

The USFS placed a four-mile boundary around the Drill Hole lek to calculate the percentage of current disturbance within that boundary. As calculated by the USFS, the total currently disturbed area as a percentage of the total area within the four-mile boundary surrounding the lek is 6.8 percent. Adding the mine plan under the proposed action, the total disturbance would be 9.2 percent, assuming all mining on NFS and private lands in the project area boundary within four miles of the lek is implemented.

As shown in Figure 8, only a portion of the project area within the four-mile boundary would be incrementally disturbed under the proposed action: a total of 505 acres of NFS lands and 274 acres of private lands. Lands within the boundary that would not be mined include 698 acres of NFS lands and 404 acres of private lands.

To further evaluate impacts to sage-grouse habitat, the amount of big sagebrush that would be disturbed under the proposed action was reviewed. As shown in Section 3.6 *Vegetation*, Table 13, there are 559 acres of big sagebrush habitats on NFS lands in the project area. Of that acreage, only 169 acres of big sagebrush habitats would be disturbed. In addition, there are 164 acres of big sagebrush habitats on private land, and 38 acres of those habitats would be disturbed.

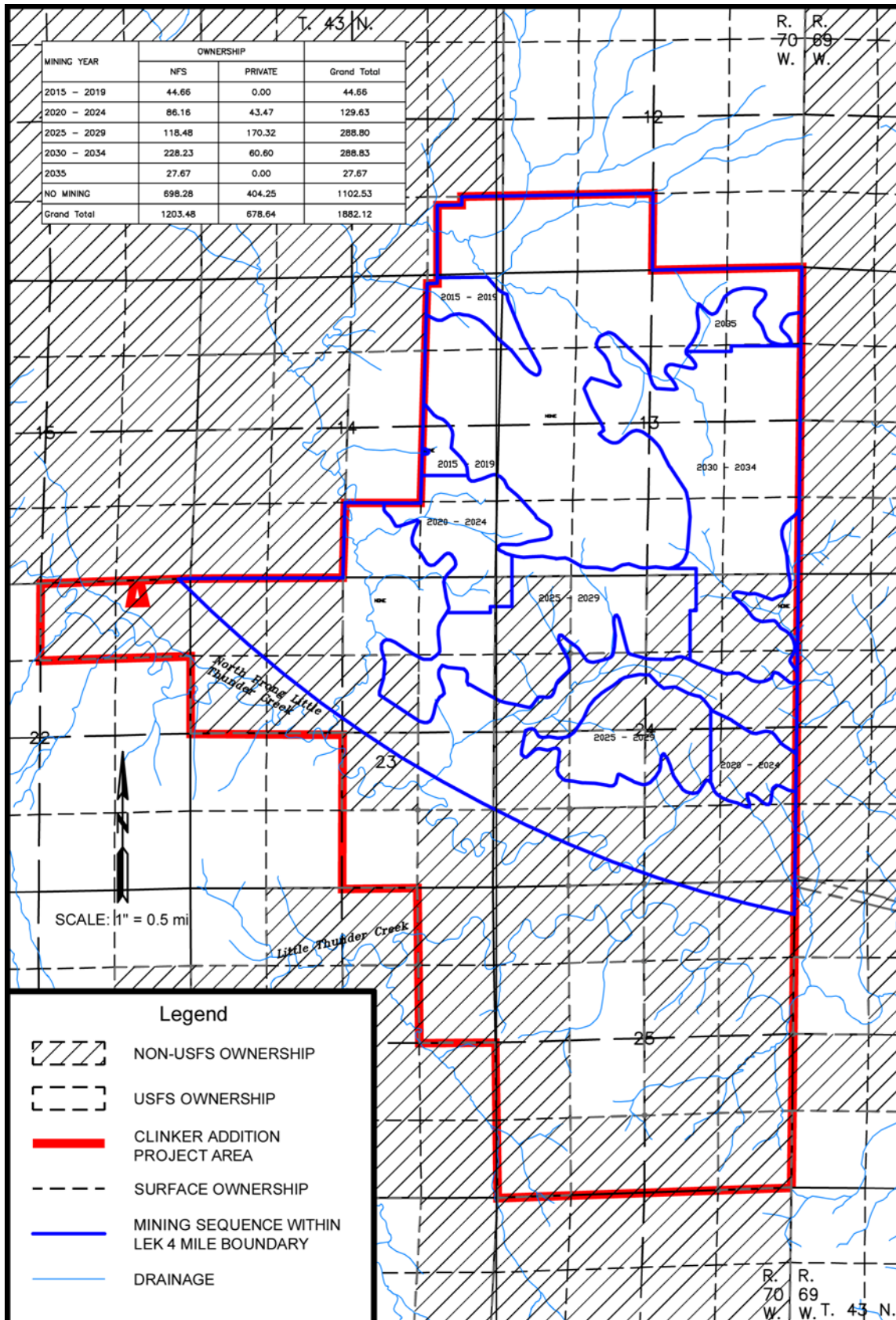


Figure 8: Mining Sequence Within Drill Hole Lek 4 Mile Boundary

Sensitive Species

Direct Effects

Effects to surface water are discussed in Section 3.4 *Water Resources*. These effects are applicable to the fish and amphibians discussed below. Mining operations will occur primarily on upland sites and not in drainages or ponds. Sediment control practices would be implemented to prevent material from entering drainages or ponds. One permitted stock reservoir would be removed by the proposed action. The upstream drainage area will remain unaffected with the exception of a short section immediately adjacent to the reservoir. These features would be replaced by TBCC during reclamation either as the same kind and number, or as otherwise requested by the landowner.

The **plains minnow, flathead chub, and finescale dace** are known to occur in Little Thunder Creek downstream from the project area. These species could migrate to the project area during peak discharges from reservoirs located upstream. In addition, they may be present on the project area during spring runoff or after intense thunderstorms when they migrate or are washed downstream from upstream habitats.

Habitat (both aquatic and adjacent upland type) for the **Northern leopard frog** is present on the project area, and this species has been observed. Disturbances associated with the proposed action would pose some level of risk due to potential vehicular collisions or by enhancing habitat for predatory species.

Several currently active **black-tailed prairie dog** colonies exist within the project area. Mining activities can impact prairie dog colonies through fragmentation or loss of foraging and burrowing habitat. Most of the mining will occur in the clinker hills while minimal disturbance will occur on the level plain areas where the prairie dog habitat is better. One black-tailed prairie dog colony will be disturbed by mining activities but not until the year 2030. Minor surface disturbance near existing colonies would provide recently upturned soils that could facilitate the expansion of the existing colonies or the establishment of new ones, as prairie dogs may readily move into recently disturbed areas. Post-mining reclamation could have similar potential benefits; prairie dogs have already demonstrated their ability to inhabit reclaimed lands at the Black Thunder Mine and at the Antelope Mine south of this project area.

Foraging habitat for the **Townsend's big-eared bat** is present within the project area. However, roosting sites of caves, abandoned underground mines or abandoned buildings are not present in the area. This species has been documented within the TBNG but has not been documented on the project area. Foraging activities may be impacted by temporary loss of habitats.

The project area generally lacks good suitable roosting habitat for the **spotted bat** but foraging habitat is present. Spotted bats have not been documented on the project area. Temporary roosting sites may be inadvertently constructed due to mining activities by creating cracks and crevices in mine high walls.

The **hoary bat** has been documented by the USFS in the general area. Suitable habitat for the Hoary bat on the project area consists of some deciduous trees along Little Thunder Creek that may provide roosting sites, but mining will not occur in this area. The project

area also contains foraging habitat for this bat species. Minimal disturbance will occur in grass prairies and greasewood flats since most of the mining will be in the clinker hills.

Limited suitable habitat for the **fringed myotis** exists on the project area. This species has been recorded by the USFS in the general area. Roosting habitats such as caves, mine tunnels and buildings are not present on the project area. However, foraging habitat is present and may be impacted by temporary loss.

Swift fox have been observed at various locations and times several miles west of the project area, but has not been observed on the project area. Due to the limited proposed disturbance of grassland and prairie dog habitats from the proposed action, and the lack of sightings in the project area, no direct or indirect impacts to swift fox are anticipated.

The **grasshopper sparrow** has been documented on the project area. There is suitable habitat for this species that consists primarily of grasslands. Most of the mining will occur in the clinker hills so disturbances to grasslands used by this species will be minimal.

The **sage sparrow** has not been documented on the project area but suitable big sagebrush habitat is present. Disturbances associated with the proposed action can impact surrounding vegetation through fragmentation or loss of foraging and nesting habitat. Linear disturbances would pose some level of risks due to potential vehicular collisions or by enhancing habitat for predators.

Habitat for the **short-eared owl** ranges from suitable (grasslands) to unsuitable (dense shrublands) on the project area. This species has been documented on the project area. Additional nesting, foraging and roosting sites may be inadvertently constructed due to mining activities. This would occur through the conversion of steep hills with more topographical relief to gently rolling hills and plains. Dense stands of shrubs may also be converted to grasslands or more open shrublands.

Potential nesting habitat for the **burrowing owl** is largely limited to the black-tailed prairie dog colonies located in the project area. Impacts on or adjacent to the colonies while burrowing owls are present may result in direct or indirect effects to nesting burrowing owls. Due to the relationship between burrowing owls and prairie dog colonies, most of the indirect effects described previously for the black-tailed prairie dog, would also apply to burrowing owls. Burrowing owls may be displaced from nesting sites by increased human activities or increased noise levels related to mining. Collisions with mine equipment may also directly impact the burrowing owl.

There is only one known **ferruginous hawk** nest site currently intact within one mile of the project area. This nest site has been actively tended only once (2001) since 1996, and has been inactive all of the other years since 1996. Due to restrictions on disturbance near active nest sites, the most probable sources of potential impact to ferruginous hawks would be the loss of foraging habitats and increase in conflicts with human presence while pursuing prey within the project area. Power lines and fences may cause injuries or fatalities due to collisions with them. Electrocutions should not be a problem on new lines because raptor protection would be installed. Surface disturbing activities could

result in a short-term, localized decrease in the prey base (lagomorphs and rodents). However, due to the high reproductive potential of small mammals and their tendencies to re-populate and adapt to disturbed and reclaimed areas, prey numbers should increase quickly after the disturbance.

McCown's and Chestnut-collared longspurs have been documented in limited numbers on the project area. Equipment operations associated with mining operations could result in fatalities or injury to individuals, nests and eggs, and/or young. Increased human activity and noise could inhibit foraging or nesting within suitable habitats or displace individuals during periods of intense activities. Potential nesting and foraging habitats in the general analysis area could be disturbed, destroyed, altered, or fragmented, though the type, timing, location, and extent of habitat disturbance will vary as mining operations progress. Within several years, newly reclaimed areas may create good quality nesting habitat for McCown's and Chestnut-collared longspurs. However, as these sites mature, they would become less suitable as nesting habitat for these species if shrubs become well established.

Only one known observation of the **mountain plover** has been documented for this area. Over the life of the mine, potential nesting and foraging habitats in the general analysis area could be disturbed, destroyed, altered, or fragmented, though the type, timing, location, and extent of habitat disturbance will vary throughout as mining operations progress. Although most of the mining will occur in the clinker hills, there will be some disturbance to the prairie dog towns that provide habitat on site that is preferred by mountain plovers. Therefore there would be little or no direct or indirect impacts to the mountain plover.

NFS lands in the project area include habitats that are suitable for nesting and foraging **northern harriers**. Equipment operations associated with the proposed action could result in fatalities or injury to individuals, nests and eggs, and/or young. Increased human activity and noise could inhibit foraging or nesting or displace individuals during periods of intense activities. Over the life of the mine, potential nesting and foraging habitats in the general analysis area could be disturbed, destroyed, altered, or fragmented, though the type, timing, location, and extent of habitat disturbance will vary as mining operations progress. Since most of the mining will occur in the clinker hills, there will be minimal disturbance to the upland and bottomland grassland areas that provide habitat preferred by northern harriers. Within several years, newly reclaimed areas may create good quality nesting habitat for northern harriers.

No **bald eagle** nests are currently present on or within one mile of the project area. Bald eagle winter roost sites are absent from project area and only a small amount of potential nesting or roosting habitat is present. As no nests, winter roost sites or large groups of bald eagles have been documented in the analysis area, potential impacts would be limited to occasional migrating and wintering individuals rather than a large segment of the population.

Mortalities or injuries could occur due to vehicular or equipment collisions when eagles are feeding on carrion near roadways. Impacts could occur from power lines; however, any new structures would be constructed with perch protection. The increased human

presence and noise associated with mining activities, if conducted while eagles are wintering within the area, could disturb or displace individual eagles during that period. However, bald eagles are commonly seen in and around the adjacent coal mines, both perched and flying, and seem to adapt to those activities. If nesting eagles were present they may be distressed to the point of abandoning eggs or young, or their hunting efforts and success impacted. If necessary, the majority of direct effects could be mitigated by controlling the timing and location of disturbance activities, and/or through approved nest relocation efforts.

Indirect effects include additional disturbance and fragmentation of foraging habitat. Conversely, the addition of fences and raptor-safe power poles could possibly benefit foraging bald eagles by providing additional perch sites. Due to the limited presence of potential nesting or roosting sites, and lack of concentrated sources of prey, the direct and indirect effects of the proposed action to bald eagles are expected to be minimal.

Loggerhead shrikes are occasionally observed on and adjacent to NFS lands within the project area. No actual shrike nests or recently fledged young have been documented on or near NFS lands in the project area, but this species most likely nests in the area. Most sightings have occurred in cottonwood-riparian corridors along Little Thunder Creek, big sagebrush shrubland, and greasewood stands. The loggerhead shrike has also been recorded perched on fences and overhead power lines at the adjacent coal mines. Loggerhead shrike foraging habitat is present throughout the project area.

The most probable direct impact would be the mortality of, or injury to, individuals foraging within or passing through the project area due to collisions with vehicles, or dispersal of foraging individuals due to active mining. Active nests could also be lost during topsoil stripping operations or other disturbances in intact nesting habitats. The relatively slow movement of mining equipment and the noise associated with the activity would decrease direct impacts associated with vehicle collisions. As loggerhead shrikes are not especially common in the project area, indirect impacts would be limited despite the fragmentation, degradation, or loss of habitat in the short and mid-term. Any birds that would be displaced would be forced to travel to other locations with acceptable habitat. This could result in stress to individual birds, as well as potential decreased nesting effort and success. Prey numbers reduced by mining would be expected to rebound following reclamation due to generally high reproductive potential and prey tendencies to re-establish and adapt to disturbed and reclaimed areas.

Given the lack of sightings of **long-billed curlews** in the project area over the last 30 years, and the fact that habitat conditions in those areas are only suitable for foraging migrants or non-breeding adults, the proposed action is unlikely to cause any direct injury or mortality to this species. Foraging individuals may be displaced by human activities and noise associated with mining. Potential foraging habitats may be disturbed, removed, or fragmented by mining activities. Reclaimed grassland areas may provide better habitats than those present prior to disturbance and will eventually mitigate impacts to some degree. The creation of wetland habitats, especially adjacent to native or reclaimed grassland habitats, could provide additional (although limited) foraging areas for curlews.

Although no nests have been encountered in the general analysis area, the presence and behavior (singing) of birds throughout spring and summer suggest that **Brewer's sparrows** nest in the sagebrush stands present on this area. Direct impacts may occur from loss of individuals, nests, nesting habitat, and foraging habitat during topsoil salvage operations. Increased activity and noise, especially during the nest initiation period, could inhibit nesting proximate to mining activities. Reclamation of disturbed areas will occur incrementally as mining is completed and will eventually mitigate impacts to sagebrush habitats to some degree, though such efforts could take decades to benefit sagebrush obligates such as the Brewer's sparrow.

Cumulative Effects

There were six Region 2 species evaluated that are strongly associated with prairie dog colonies or other areas with short, sparse vegetation: the **black-tailed prairie dog, swift fox, mountain plover, burrowing owl, chestnut-collared longspur, and McCown's longspur**. Despite the presence of additional habitat outside the analysis area, cumulative effects expected for these six species would include habitat destruction, alteration, and fragmentation. Some individuals may be killed or injured by topsoil removal, vehicles or equipment, collisions with fences, and illegal poisoning or shooting. Predation rates on some species may increase due to the creation of favorable habitats, perches, or travel corridors for predators. Nests of avian species will likely be destroyed or compromised by human disturbances or activities, and individuals (especially avian species) will likely be displaced from existing territories. Such occurrences would increase competition for available adjacent habitats. If those areas have already reached carrying capacity, the result would be intra-specific competition followed by nutritional stress, decreased fecundity, and/or mortality.

Mining would impact sagebrush shrubland/mixed prairie grassland habitats that are present. Evaluated Region 2 sensitive species for mixed grassland habitats included the **swift fox, grasshopper sparrow, ferruginous hawk, northern harrier, short-eared owl, and long-billed curlew**. Cumulative impacts to those species would be similar to those described above. However, as all of these species have the capacity of utilizing a variety of habitats, including prairie dog colonies and short-grass areas, beyond the overall analysis area, the cumulative effects would be somewhat lessened.

Regarding the **swift fox and ferruginous hawk**, the fragmentation, alteration, or destruction of suitable habitats would also destroy denning and shelter sites or nest sites, respectively, and would potentially facilitate inter-specific competition for available prey bases. Both the swift fox and hawks using these habitats would also be negatively affected by activities that reduce prey availability. The impacts would be partially mitigated by the existing presence of alternate denning and nesting sites in the area that would not be disturbed by the proposed action. Additional threats to mixed sagebrush and/or mid-grass species would arise from the creation of habitat patches that are too small to attract individuals or sustain viable breeding pairs or populations.

The Region 2 sensitive species associated with sagebrush or other shrub habitats that could occur in or near the project area include the **Greater Sage-Grouse, loggerhead shrike and Brewer's sparrow**. Nearly 30 years of Greater Sage-Grouse surveys with minimal sightings have demonstrated the project area does not provide optimum sage-

grouse habitat. Sage-grouse would likely experience minimal cumulative impacts by the proposed action. Similarly, the relatively small size of the clinker mining operation would likely have minimal cumulative impacts on the loggerhead shrike and Brewer's sparrow.

Region 2 sensitive species generally associated with tree areas in the project area are the **Townsend's big-eared bat, hoary bat, fringed myotis and bald eagle**. Very few to no deciduous trees should be removed by activities since they are located along Little Thunder Creek and most of the mining will occur in the clinker hills. A few scattered coniferous trees on hill slopes may be lost if those areas are mined. Numerous coniferous trees are present in the Rochelle Hills immediately east of the project area so alternate coniferous tree habitat is readily available nearby. Detailed tree inventories would be conducted prior to all mining disturbances, as required by State and Federal agencies, so every tree that is lost to mining would be replaced during reclamation.

Sensitive species associated with aquatic habitats analyzed include the **plains minnow, finescale dace, flathead chub, and northern leopard frog**. The fish species and frogs are not prevalent within the project area, and therefore have little potential to be affected by cumulative impacts from the proposed action. Wetland and aquatic habitats are considered very poor to unsuitable on NFS and other lands within the project area because of the lack of perennial water necessary for these species to survive and/or reproduce. None of the fish species have been recorded along the ephemeral creeks on the site but leopard frogs have been observed on NFS lands within this project area. Dewatering or degradation of breeding habitats could kill eggs, tadpoles, or over-wintering adults, as well as increase predation rates on adults and eggs. Conversely, the creation and augmentation of aquatic habitats by sediment control ponds could maintain and possibly increase local northern leopard frog or small fish populations.

In summary regarding USFS Region 2 Sensitive Species, despite the potential death, injury, and displacement of some individuals, the cumulative impacts associated with the proposed action are not expected to significantly reduce the size or viability of populations of any of the Sensitive Species. These species are not known to be present or abundant in this area.

Species of Local Concern

Direct Effects

Direct loss or injury to individual birds may occur as a result of ground disturbance associated with project implementation if those birds are present at the time. Disturbance from project construction and operations may also displace individuals due to noise and general increased human or equipment activity in the area.

Cumulative Effects

Over the life of the mine, potential nesting and foraging habitats in the general analysis area could be disturbed, destroyed, altered, or fragmented, though the type, timing, location, and extent of habitat disturbance will vary throughout the general analysis area as mining operations progress. Reclamation of disturbed areas will occur incrementally. Within several years, newly reclaimed areas may create good quality nesting habitat for some grassland species. Reclaimed habitat for shrubland species would take longer to become available since shrublands typically take longer to develop.

Biological Determination for Alternative 1 - No Action

Threatened, Endangered, Proposed, and Candidate Species

The biological assessment of the No Action alternative is **No Effect** for the black footed ferret because no habitat or individuals occur within the project area. The biological assessment of the No Action alternative for the Candidate species Greater Sage-Grouse is shown below in the MIS section.

Management Indicator Species

The Greater Sage-Grouse is the listed MIS species and was also evaluated as a Sensitive species. Although minimal sage-grouse sightings have been observed over an extended period, because of the prevalence of potential habitat in the TBNG and adjacent private lands, the USFS wildlife specialist has determined the No Action alternative is likely to **impact individuals, but is not likely to cause a trend in federal listing or loss of viability in the planning area.**

Sensitive Species

Implementation of the No Action alternative may impact localized, foraging, transient, or migrating individuals on NFS lands as clinker mining is conducted on adjacent private lands. A biological evaluation of **may impact individuals, but is not likely to result in a loss of viability in the planning unit, nor cause a trend toward Federal listing** was made for all sensitive species.

Species of Local Concern

Implementation of the No Action alternative may impact localized, foraging, transient, or migrating individuals on NFS lands as clinker mining is conducted on adjacent private lands. A biological evaluation of **may impact individuals, but is not likely to result in a loss of viability in the planning unit, nor cause a trend toward Federal listing** was made for species of local concern.

Biological Determination for Alternative 2 – Proposed Action

Threatened, Endangered, Proposed, and Candidate Species

The Black-footed ferret and Greater Sage-Grouse are the only Endangered, Threatened, Proposed, or Candidate species with suitable habitat within the project area. A 2004 USFWS memorandum determined ferret surveys were no longer required and that wild populations of black-footed ferret do not exist in the area. A biological determination of **No Effect** was made for Threatened and Endangered species because no species occur within the project area. The determination for the Greater Sage Grouse is listed below in the MIS section.

Management Indicator Species

Analysis of sage grouse habitat that could be impacted by the planned development was included in the report, and the evaluations are reflective of the known conditions in the area and are appropriate for the species represented. The expected impacts are accurately portrayed, and the conclusions are reasonable, with the following correction to the determination: **May impact individuals, but is not likely to cause a trend in federal**

listing or loss of viability in the planning area. This change in determination is based on the addition of onsite and offsite mitigation listed below. By doing offsite and onsite mitigation with this project, the negative impacts should be offset by the positive impacts from the mitigation. This is in addition to applying all standards and guidelines in the LRMP that will further protect sage grouse. Therefore this project should not contribute to a net loss in habitat for sage grouse, or contribute to the direct, indirect, or cumulative impacts.

Sensitive Species

Implementation of the Proposed Action may impact localized, foraging, transient, or migrating individuals. A biological evaluation of **may impact individuals, but is not likely to result in a loss of viability in the planning unit, nor cause a trend toward Federal listing.**

Species of Local Concern

Implementation of the Proposed Action may impact localized, foraging, transient, or migrating individuals. A biological evaluation of **may impact individuals, but is not likely to result in a loss of viability in the planning unit, nor cause a trend toward Federal listing** was made for species of local concern.

Table 25 summarizes the determinations of impacts for Region 2 Sensitive Species and Management Indicator Species evaluated under the no action and proposed action alternatives, and the primary proposed action justifications.

Table 22: Determination of Impacts for USFS Region 2 Sensitive Wildlife Species and Management Indicator Species Evaluated under the No Action and Proposed Action Alternatives, and Primary Proposed Action Justifications

Evaluated Species	Impacts Determination		Justification
	No Action Alternative ¹	Proposed Action Alternative	Proposed Action Alternative
FISH			
Plains minnow	May impact individuals ²	May impact downstream individuals ³	Clinker occurs in upland areas and stream channels would not be directly affected, but surface water flow may be affected under either alternative due to changes in topography and infiltration adjacent to channels.
Finescale dace	May impact individuals ²	May impact downstream individuals ³	Clinker occurs in upland areas and stream channels would not be directly affected, but surface water flow may be affected under either alternative due to changes in topography and infiltration adjacent to channels.
Flathead chub	May impact individuals ²	May impact downstream individuals ³	Clinker occurs in upland areas and stream channels would not be directly affected, but surface water flow may be affected under either alternative due to changes in topography and infiltration adjacent to channels.
AMPHIBIANS and REPTILES			
Northern leopard frog	May impact localized individuals ³	May impact localized individuals ³	Some risk of vehicle collisions, enhanced habitat for predators. Creation of aquatic habitat by sediment control ponds could support populations.

Evaluated Species	Impacts Determination		Justification
	No Action Alternative ¹	Proposed Action Alternative	Proposed Action Alternative
MAMMALS			
Townsend's big-eared bat	May impact foraging individuals ³	May impact foraging individuals ³	Lack of sightings on project area. No suitable roosting habitat; temporary loss of foraging habitat.
Black-tailed prairie dog	May impact individuals ³	May impact individuals ³	Minimal disturbance to level plain areas. Disturbances and reclamation near colonies facilitate expansion. USFS mitigation standards and guidelines apply.
Spotted bat	May impact foraging individuals ³	May impact foraging individuals ³	Lack of sightings on project area. No suitable roosting habitat; temporary loss of foraging habitat. May create temporary roosting sites.
Hoary bat	May impact foraging individuals ³	May impact foraging individuals ³	Suitable roosting habitat outside mining area; temporary loss of foraging habitat.
Fringed myotis	May impact foraging individuals ³	May impact foraging individuals ³	No suitable roosting habitat; temporary loss of foraging habitat.
Swift fox	May impact localized individuals ³	May impact localized individuals ³	Lack of sightings in project area. Limited disturbance of grassland and prairie dog habitats.
BIRDS			
Grasshopper sparrow	May impact localized individuals ³	May impact localized individuals ³	Minimal disturbance of grassland habitat.
Sage sparrow	May impact localized individuals ³	May impact localized individuals ³	Lack of sightings in project area. Temporary fragmentation or loss of foraging and nesting habitat.
Short-eared owl	May impact localized individuals ³	May impact localized individuals ³	May create additional nesting, roosting, and foraging habitat.
Burrowing owl	May impact localized individuals ³	May impact localized individuals ³	Similar effects as prairie dogs. USFS and TBCC BTM permit mitigation standards apply during breeding season.
Ferruginous hawk	May impact localized individuals ³	May impact localized individuals ³	One known, intact nest outside project area. USFS, USFWS, APLIC, and TBCC BTM permit mitigation standards apply.
McCown's longspur	May impact localized individuals ³	May impact localized individuals ³	Individuals and habitat could be affected by equipment, human activity, noise, and disturbances. Newly reclaimed areas provide good nesting habitat.
Chestnut-collared longspur	May impact localized individuals ³	May impact localized individuals ³	Individuals and habitat could be affected by equipment, human activity, noise, and disturbances. Newly reclaimed areas provide good nesting habitat.
Greater sage-grouse	Likely to result in loss of viability or trend toward Fed. listing	Likely to result in loss of viability or trend toward Fed. listing	Possible long term loss of habitat depending on reclamation of big sagebrush. Human activity and noise may cause avoidance or affect breeding. Potential vehicle collisions. Increased risk of predation. Potential illegal harvest. Loss of forage.
Mountain plover	May impact individuals ³	May impact individuals ³	Minimal disturbance to the prairie dog towns that provide habitat.

Evaluated Species	Impacts Determination		Justification
	No Action Alternative ¹	Proposed Action Alternative	Proposed Action Alternative
Northern harrier	May impact localized individuals ³	May impact localized individuals ³	Minimal disturbance to upland and bottomland grassland areas. Newly reclaimed areas provide good nesting habitat within several years.
Bald eagle	May impact transient or wintering individuals ³	May impact transient or wintering individuals ³	No nests, winter roost sites or large groups observed in project area. New perch sites could benefit foraging. USFWS and TBCC BTM permit mitigation measures apply.
Loggerhead shrike	May impact localized individuals ³	May impact localized individuals ³	No shrike nests or fledged young documented on or near NFS lands in the project area. USFS standards and guidelines apply to active nest sites.
Long-billed curlew	May impact localized individuals ³	May impact localized individuals ³	Lack of sightings in project area. Reclaimed grassland areas may provide better habitats.
Brewer's sparrow	May impact localized individuals ³	May impact localized individuals ³	No nests encountered in project area. USFS standards and guidelines for sagebrush habitats implemented as necessary.

¹ Under the No Action alternative, potential would remain for wildlife on NFS lands to be affected by mining on adjacent private lands.

² Mining on adjacent private lands and upstream Black Thunder TEAL Amendment Permit Area could alter surface water flow regimes.

³ May impact individuals but is not likely to result in a loss of viability in the planning unit, nor cause a downward trend that leads to federal listing.

Cumulative Effects

Past and present activities within the project area include surface mining, livestock grazing, fence construction and maintenance, wildlife use, recreational activities, oil well drilling, and fire suppression activities. Similar activities occur in the surrounding area, with the addition of large scale surface coal mining and CBNG production. Future activities are expected to be similar, although livestock grazing and recreational activities would be suspended in fenced active mine or reclamation exclusion areas.

Mitigation

USFS Standards and Guidelines specified in the Grassland Plan (USFS 2002), TBCC's current Black Thunder Mine permit, and USFWS requirements provide mitigation requirements for multiple species that help alleviate some of the direct, indirect, and cumulative effects.

TBCC has avoided where possible or mitigated mining impacts on **raptor** nests through a variety of means. The Black Thunder Mine has voluntarily monitored nesting raptor populations in a perimeter larger than required annually since 1983, maintained and implemented current USFWS-approved Raptor Mitigation Plans, adjusted operations to provide temporal and spatial buffers around raptor nests, and ensured that new power lines at the mine conform to current Avian Power Line Interaction Committee (APLIC)

guidelines. USFS Standards and Guidelines would be implemented and offer additional protections for active nests.

Impacts to sagebrush habitat on USFS lands could be further mitigated off-site by efforts to preserve and enhance such habitat on adjacent and nearby private lands. **Black Thunder Mine will contribute \$1,700 of cheatgrass herbicide; in order to offsite mitigate approximately 320 acres of affected Greater Sage-Grouse habitat within the project. Offsite mitigation (cheatgrass control) will occur in an area on TBNG that is of higher value for sage grouse habitat.**

Standards and Guidelines for sagebrush habitats outlined in the Grassland Plan would be implemented as necessary.

Additional Mitigation and Monitoring Requirements

- To help protect R2 sensitive species the operator will notify the District Ranger, Douglas Ranger District, if a sensitive species nest in addition to those identified in the BA/BE are located during construction or operation of the project.
- Reclamation will be completed in a prompt timeframe.
- The timing limitation of March 1- through July 31, to protect nesting Greater Sage-Grouse and raptors, will be permanently in place for the duration of this project for crushing and large equipment use.
- Aggressive weed control will be implemented for the whole project area for the life of the project.
- Dust abatement will be utilized for the life of the project.

Irreversible and Irretrievable Commitments of Resources

No irreversible impacts to vegetation are expected from the Proposed Action Alternative. Irretrievable commitments would occur as temporary displacement of individuals during active mining and potential habitat loss for some species in disturbed areas until final reclamation is complete.

3.9. Land Use and Recreation _____

3.9.1. Affected Environment

The project area consists primarily of rangeland utilized for livestock grazing and wildlife use. In addition to being permitted for livestock grazing, the accessible NFS lands are open to the public for recreational pursuits. Within the project area, NFS lands located adjacent to or north of Highway 450 are accessible across NFS lands, with an unimproved two-track road extending into the area from the highway. NFS lands south of the highway (but not adjacent) are surrounded by privately-owned surface and are accessible for walk-in public recreational opportunities only with landowner permission.

Grazing

The USFS grazing permit within the project area is held by the Thunder Basin Grazing Association which manages various allotments under the issued agreement. The Thunder Basin Grazing Association then grants permits to its members for grazing on individual allotments. NFS lands within the project area comprise portions of the Kerr McGee, Little Thunder, and Stringer grazing allotments as summarized in Table 23.

The USFS grazing permit indicates NFS lands within the project area provide forage adequate to support 0.16-0.24 animal unit months (AUMs) per acre of grazing annually for an estimated total of 101 AUMs over the 540-acre disturbance area as summarized in Table 26. One AUM is defined as the amount of air dried forage required to feed one mature 1,000 pound cow (or equivalent) for one month, based on an average consumption rate of 26 pounds/day (Ruyle and Ogden 1993).

The Thunder Basin Grazing Association invoices its members for permitted AUMs plus any additional fees such as annual dues and assessments. The Association uses some of the fees collected for administrative expenses and Conservation Practices. Conservation Practices include replacement of fences, stock tanks, and windmills beyond useful life, maintenance, and brush control (Eathorne 2001).

As opposed to USFS allotment management, grazing on private lands is conducted at the discretion of the landowners. These lands generally support similar vegetation communities and forage availability as nearby NFS lands. Under that assumption, private lands would be expected to provide approximately 82 AUMs/year of forage across the 481 acres proposed for disturbance.

Table 23: Grazing Allotment Summary for NFS Lands with the Project Area

Allotment #	Allotment Name	Permit Holder ¹	Portion of Project Area Included	Permitted AUMs/Acre	Area Affected by Mining (Acres)	AUMs Affected by Mining ²
214a	Kerr McGee	Justin Edwards	Sections 11-14 and 24	0.18	455	83
273	Little Thunder	Guy Edwards, Edwards Trust	Sections 23 (except NE1/4) and 25	0.16	35	6
274	Stringer	Justin Edwards	NE1/4 Section 23	0.24	50	12
Total (NFS Lands within project area):					540	101

¹ All permits are for cattle.

² Maximum effect/year for total mined area. Actual effects would be incremental unless the entire area was fenced for the duration of mining.

Totals may vary slightly due to rounding of decimal places in data subsets.

For operations to be conducted in a safe manner, the active scoria mining area and a surrounding buffer would be fenced to exclude livestock grazing for the duration of the

exclusion period, resulting in a reduction of the number of available AUMs. The exclusion period would encompass mining and reclamation through bond release. The total number of acres excluded from grazing and the duration for which those acres are excluded will vary year to year. Based on the USFS permit AUMs, the total proposed mining area on NFS lands provides 101 AUMs of grazing that will be lost during incremental mining for the duration of the exclusion period. The exclusion area will be incremental as mining progresses and will increase annually until areas are removed from exclusion after reclamation and bond release is complete. As AUMs are incrementally lost until reclamation is complete, fees collected by the Thunder Basin Grazing Association for administrative expenses and Conservation Practices would also be reduced.

Grazing would resume after the reclamation process is completed. WDEQ-LQD requires reclamation to return the land to an equal or better state with regard to identified land use. Post-mine livestock grazing opportunities are expected to be equal to or better than pre-mine grazing. Forage quality and quantity post reclamation will ultimately depend upon factors such as re-spread soil quality and depth, seed mix utilized, and growing conditions during the re-vegetation period.

Recreation

Recreational opportunities within the project area are limited. No developed recreation opportunities in the form of campgrounds or trailheads occur within the project area or general vicinity. Motorized recreation is allowed only on existing NFS roads. Dispersed recreation in the form of camping, hunting, target shooting, horseback riding, backpacking, and mountain biking may occur. General use is expected to be minimal due to lack of unique features within the area, proximity to existing coal mines, and availability of similar opportunities in the surrounding area. Hunting and target practice activities are likely the most common recreational uses.

The active scoria mining area and surrounding buffer would be fenced to exclude public access for the purposes of safety and mining efficiency. The total number of acres excluded from public access and the duration for which those acres are excluded will vary year to year.

3.9.2. Environmental Consequences

3.9.2.1. Alternative 1 – No Action

Direct and Indirect Effects

Under the No Action Alternative, mining would not be implemented on NFS lands within the project area under this proposal, and current grazing and recreational use would be expected to continue. The potential for mining would remain on private lands.

Cumulative Effects

Although neither grazing nor recreation would be affected on NFS lands within the project area under the No Action Alternative, both activities have been excluded by regional mining processes in the past and additional areas may be excluded in the future

as regional mining progresses. Excluded areas would be re-opened to both activities after completion of reclamation.

Active coal mining would continue in nearby currently permitted areas and potential for mining on private lands within the project area would remain. Other activities such as ranching and oil and gas exploration and production would also be expected to continue in the general area.

Any increase in surface disturbance and human activity would increase the potential for spread and establishment of weeds. Weed spread or establishment can be detrimental to rangelands by lowering yield and quality of forage and reducing plant diversity as well as adding to the potential for interfering with grazing, poisoning animals, and increasing livestock production and land management costs through need for weed control (DiTomaso 2000).

3.9.2.2. *Alternative 2 – Proposed Action*

Direct and Indirect Effects

Implementation of the Proposed Action would exclude the mined area and the surrounding, undisturbed buffer area from grazing and recreation opportunities.

Access to a portion of the total 540 acres of NFS lands providing an associated 101 AUMs annually would be lost incrementally based on timing and location of exclusion fences until such time that the reclamation and bond release process is complete. After an area has achieved bond release, it would no longer be excluded from grazing or dispersed recreation activities. Motorized access to areas not located within exclusion fences would be available from existing NFS roads. Non-motorized access (walking, horseback) would be available across all NFS lands not located within exclusion fences.

Recreation opportunities would be affected based on type. Public access would be prohibited inside of incrementally fenced exclusion areas to ensure public safety. The total area unavailable for recreation would be determined by the relative location of exclusion areas and NFS access roads (i.e., some areas may be open for recreation but inaccessible due to road location) or off-road access for non-motorized travel.

Cumulative Effects

Grazing and recreation activities would be incrementally excluded through fencing or access restrictions by current and proposed mining activities. Areas would be re-opened to both activities after completion of reclamation and associated bond release. Other activities such as ranching and oil and gas exploration and production would have the potential to continue in the general un-mined area.

Any increase in surface disturbance and human activity would increase the potential for spread and establishment of weeds. Weed spread or establishment can be detrimental to rangelands by lowering yield and quality of forage and reducing plant diversity as well as adding to the potential for interfering with grazing, poisoning animals, and increasing

livestock production and land management costs through need for weed control (DiTomaso 2000).

Cumulative effects to grazing would also occur as Wright area coal lease-by-application tracts are mined (USDI BLM 2010). In addition to temporary loss of forage as a result of vegetation removal/disturbance and temporary loss of AUMs, other effects include:

- temporary loss of water-related range improvements, such as improved springs, water pipelines, and stock ponds;
- temporary loss of other range improvements, such as fences and cattle guards; and
- restricted movement of livestock within an allotment due to the development and operation of projects like surface coal mines, which would cease after successful reclamation had been achieved and replacement of water-related and other range improvements had been completed.

Irreversible and Irretrievable Commitments of Resources

No irreversible impacts to land use and recreation are expected from the Proposed Action Alternative. Irretrievable commitments would occur as:

- 0.16-0.24 AUMs/acre of grazing for the duration of exclusion areas; and
- Recreational opportunities on NFS lands within exclusion areas for the duration of exclusion.

3.10. Travel Management

3.10.1. Affected Environment

The project area road system includes portions of State, NFS, and private roads. Figure 2: Project Area Overview shows the relative location of major roads within and surrounding the project area. State Highway 450 is a paved, two-lane highway and is the primary means of east/west travel in the immediate area. Secondary (NFS and private) and County roads provide local area access off Highway 450. County Road 89 extends north of Highway 450 east of the project area.

Public access to NFS lands in all or portions of Sections 13, 14, 23, and 24, T43N R70W is provided from State Highway 450 on NFSR (National Forest System Road) 1108.D. NFSR 1108.D is a two-track classified by the USFS as limited to high-clearance vehicles.

NFSR 1108.D connects to other NFS roads within the project area including 1108.B, 1108.C, and 1108.E. NFSRs 1108.B and 1108.C are also classified as High Clearance. NFSR 1108.E is classified as Moderate Use but has been disturbed and reclaimed during historic Jacobs Ranch Mine operations and is no longer a viable means of access, although the USFS still retains the right of way.

A network of two-tracks on adjacent private surface provides grazing lease access to private and NFS lands for maintenance purposes; these roads are not open to public use. See Section 3.9: *Land Use and Recreation* for additional grazing information.

Secondary road designations within and intersecting the project area include High Clearance, User Created, and Non NFS Access. See Table 27 for roads and designations within the project area.

Table 24: Secondary Road Designations Within and Intersecting the Project Area

Project Area	Road Name	Road Length (Mi)	Reclaimed to Existing Status
High Clearance	NFSR 1108.B	1.9	Yes
	NFSR 1108.C	2.2	Yes
	NFSR 1108.D	1.6	Yes
	Unnamed	0.3	Yes
	Total High Clearance	5.9	--
User Created	Unnamed	3.3	No
	Total User Created	3.3	--
Non NFS Access	HWY 450	2.7	Unaffected
	Unnamed	1.4	Yes
	Total Non NFS Access	4.1	--

High Clearance roads are open to the public and provide recreational access to NFS lands in addition providing custodial care access for lessees and USFS-authorized access. This road designation may consist of native and upgraded road surfaces.

User Created roads are two-tracks and trails created by motor vehicle use off approved NFS roads. User Created roads are unauthorized and may cross sensitive areas with little regard for environmental impacts.

3.10.2. Environmental Consequences

3.10.2.1. Alternative 1 – No Action

Direct and Indirect Effects

Under the No Action Alternative, no clinker mining would occur on NFS lands within the project area but the potential for clinker mining on adjacent, private lands would remain. General public access to NFS lands would not be affected under the No Action Alternative. Direct access to NFS grazing lease lands may be temporarily disrupted by clinker mining operations on adjacent private property, thus requiring lessees to use alternate, indirect routes.

Cumulative Effects

To offset the shortfall of clinker not mined from project area NFS lands under the No Action Alternative, clinker would need to be purchased from other sources in the region and hauled to the Black Thunder TEAL Amendment Permit Area. This would result in an increase of heavy truck and trailer traffic on State Highway 450. Impacts from increased heavy truck traffic are discussed in Section 3.2 Air.

3.10.2.2. Alternative 2 – Proposed Action

Direct and Indirect Effects

Under the Proposed Action, clinker mining would take place on private and NFS lands within the project area. Active mining will result in an incremental closure of NFS public access roads within the project area during mining and reclamation until final bond release.

Roads within or intersecting active mine areas will be closed for varying amounts of time to ensure public safety. Exclusion fences will be erected to maintain a buffer between areas open to the public and mine operations. No public access will be allowed within the exclusion fence and may be limited on lands immediately adjacent to the exclusion areas for safety purposes. For more information on exclusion zones and adjacent areas, see Section 3.9: *Land Use and Recreation*.

Public access to NFS lands will be incrementally reduced beginning in 2015. In 2015, the mining sequence is projected to cross the primary NFS public access road (NFSR 1108.D) approximately 0.6 miles north of State Highway 450. Another portion of NFSR 1108.D will be mined though beginning in 2020 approximately 0.25 miles north of Highway 450.

Pending bond release after reclamation, mined areas will be incrementally released from the exclusion area and the exclusion fences removed. Grazing will resume on reclaimed areas, but recreational activities may be limited depending on the status of the adjacent land. See Section 3.9: *Land Use and Recreation* for additional details.

Haul roads will be created as part of the mining operation. Haul roads will be utilized to transport material to the processing facilities or stockpiles, or to directly haul the material to the Black Thunder TEAL Amendment Permit Area. Haul roads critical to production will remain in use for the life of the clinker mining operation. Haul road corridors will be fenced, and public access across them will be prohibited to ensure public safety.

Public access will remain open, however may be limited until approximately 2046 when the mining sequence has ended and bond release is achieved on all reclaimed areas. Reclaimed areas that have been released from bond requirements will no longer be considered exclusion areas.

Clinker mining on NFS lands within the project area will not affect State Highway 450 use. Portions of NFS lands within the project area will not be affected by the mining sequence and will continue to be available for grazing by lease, but lessee access to the lands may be limited at times as mining progresses. Lessee access to NFS lands will be through adjacent private surface or active haul roads under controlled conditions to ensure safety. The general public will not have access to areas leased for grazing.

Cumulative Effects

No cumulative effects to travel management are expected under the Proposed Action as NFS roads and access would eventually be restored. Mined out areas would be reclaimed over time as new areas are disturbed. Reclamation and bond release is expected to take up to 10 years to complete after mining ceases. These areas would continue to be closed to public access during the reclamation and bond release process. Previously authorized NFS roads would be reclaimed to the pre-disturbance condition and status unless modified in the USFS Travel Management Plan during the active mining or reclamation and bond release time periods.

Irreversible and Irretrievable Commitments of Resources

No irreversible impacts to travel management are expected from the Proposed Action Alternative. Irretrievable commitments would occur as access to NFS lands within exclusion areas for the duration of exclusion.

3.11. Scenic Resources

3.11.1. Affected Environment

Landscapes within and surrounding the project area is characterized by gently rolling hills transforming to steep scoria ridges along the burn line. Open expanses of sagebrush and short-grass prairie are predominant. The Grassland Plan establishes Scenic Integrity Objectives (SIOs) for the general area that allow facilities and landscape modifications to be visible, but call for reasonable mitigation to blend and harmonize with natural features.

The project area supports two-track roads, ranching activities, and reclaimed historic mining areas. The surrounding area landscape has been altered by oil and gas fields, ranching activities, transportation activities, utility corridors, environmental monitoring installations, and large scale surface coal mines. Visible man-made structures within the general area include oil well pumps, storage tanks, pipeline and utility right-of-ways, water storage reservoirs, public and private roads, road signage, power and utility transmission lines, railroads, fences, ranch buildings, livestock, abandoned homesteads, open-pit coal mines, topsoil and overburden stock piles, silos, and loading facilities. The primary use of lands immediately to the north, west, and south of the project area is mining while the primary use to the east is grazing, both of which occur throughout the general area.

Portions of the affected area would be visible from Wyoming State Highway 450, County Road 89, private roads, and two-track roads. Portions of the affected area would also be visible from existing mines and ranch lands surrounding the site.

3.11.2. Environmental Consequences

The TBNG covers approximately 572,000 acres of which 541 acres (0.094%) of NFS lands and 481 acres of private lands would be disturbed by the Proposed Action. Mining would occur on scoria hills located on both sides of Highway 450 and on the west side of County Road 89. Some of the mining related activities would be visible from the roads,

while others would be obscured by local topography. Timing, extent, and duration of visual effects would be determined by location within the landscape and the mining sequence. The proposed mining area and incremental mining sequence are presented on Figure 3 in Chapter 2.

The Grassland Plan has established scenic integrity objectives (SIO) for the TBNG. Because landscapes in the general area have been moderately altered, a low SIO has been assigned to the project area. Project facilities and landscape modifications would be visible from some locations at some points in time, but would be reasonably mitigated to blend and harmonize with natural or surrounding features during the reclamation process.

3.11.2.1. Alternative 1 – No Action

Direct and Indirect and Cumulative Effects

Under the No Action alternative, no clinker would be mined on NFS lands within the project area so no visual impacts would occur under this project. Mining and reclamation activities would continue to occur in currently permitted areas to the north, west, and south of the project area and would have the potential to occur on privately owned lands within the project area, thus altering surrounding scenic resources over time.

3.11.2.2. Alternative 2 – Proposed Action

Direct and Indirect Effects

Mining activities proposed under Alternative 2 would remove vegetation, expose soils, extract materials, and reclaim disturbed areas as determined by the mining sequence. The mined clinker would be crushed on site, hauled to the neighboring coal mine, and used as construction and surfacing material. Some scoria mining activities would be visible from Highway 450, County Road 89, private roads, and two-track roads during mining, but the extent and duration of visibility would vary depending upon location in the landscape.

Landscape character would be restored to approximate original contour during reclamation and would be reseeded with an approved seed mixture, including native species. Reclaimed areas would resemble surrounding undisturbed or reclaimed terrain, although slopes would appear smoother and less steep than undisturbed terrain. Sagebrush or other shrubs may be less abundant; however the mined land would generally blend with adjacent landforms and vegetation following reclamation.

No unique scenic resources have been identified on or near the project area.

Cumulative Effects

Scenic resources would be slightly altered over time by mining activities. The mining activities under the Proposed Action would contribute temporarily to the overall scenic resources in the project area. Reclamation activities would occur in the project area as well as on adjacent private lands and currently permitted areas to restore the landscape.

In addition to clinker mining on NFS lands, adjacent mining and reclamation activities would continue to occur in currently permitted areas to the north, west, and south of the project area and would have the potential to occur on privately owned lands within the project area, thus altering surrounding scenic resources over time

Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable impacts to scenic resources are expected from the Proposed Action Alternative.

3.12. Paleontological Resources _____

3.12.1. Affected Environment

The project area is generally composed of gently rolling hills, ridges, and draws supporting vegetation cover ranging from 0-95%. Rock outcrop areas are poorly to moderately exposed as a result of the topography and vegetation cover, with the best exposures occurring as steep banks along minor drainages. The areas of highest potential for yielding paleontological resources are exposed bedrock outcrops with minimal loose rock and soil or vegetative cover.

The USFS Rocky Mountain Region has developed a Fossil Yield Potential Classification (FYPC) of geological formations reflecting their probability of containing significant paleontological resources. The FYPC is designed to provide USFS management with a way to prioritize protection of paleontological resources. Under this system, geologic units are classified on a scale of 1 to 5 (with 5 as the highest paleontological sensitivity) to reflect the likelihood of containing significant paleontological resources.

Bedrock geology within the project area is comprised of sedimentary rocks from the Lower Tertiary Period, dominated by the Paleocene Fort Union Formation with minor exposures of the Eocene Wasatch Formation. The late Paleocene-Eocene Wasatch Formation has been known to produce abundant and significant paleontological resources in several basins throughout the region. Occurrences of significant fossils in the Powder River Basin (within which the project area occurs) have been more sporadic and less common than other basins. Only the Lebo Member of the Fort Union Formation is exposed within the project area, and this member has been known to be less significant than others in regard to paleontological resources.

The Fort Union Formation in the project area has been ranked as a Class 3 formation under the FYPC system. Class 3 geologic units are defined by the USFS as “fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence; or sedimentary units of unknown fossil potential.” A pedestrian survey of the potentially productive portions of a project area is required for formations ranked as levels 3 through 5.

No previously discovered paleontological localities were identified during background research of the project area. Three new paleontological localities were identified during surveys conducted in August and September 2010, one of which occurs on NFS lands. The three new localities consist of fossil plant assemblages that are considered to have

little scientific significance and have potential to be affected by the Proposed Action. The entire project area was block surveyed. A report documenting the findings of the survey was prepared and submitted to the TBNG-DRD for review.

One locality containing various broad leaf imprints in thinly laminated siltstones was identified on NFS lands as a result of the field survey. The leaf impressions were very well preserved and showed remarkable detail including very fine veins. The siltstones were thinly laminated and tan to reddish-brown. The impression producing siltstones were lenticular in form and often overlaid white sandy mudstone. The whole site was capped by buff tan, well cemented, fine- to medium-grain sandstone.

The locality is within the Lebo Member of the Fort Union Formation. Bedrock is very well exposed along the hillside at the locality and in the immediate vicinity. Plant impressions such as these are common throughout the Powder River Basin in both the Fort Union and Wasatch Formation and historically were considered to be of little scientific importance. No further mitigation measures are recommended based on the abundance of plant localities throughout the Powder River Basin and the lack of significant new data which can be derived from this locality.

3.12.2. **Environmental Consequences**

3.12.2.1. **Alternative 1 – No Action**

Direct and Indirect Effects

No mining would be initiated on NFS lands with the project area under the No Action Alternative but potential for mining would remain on adjacent private lands.

Cumulative Effects

Weathering processes would continue on exposed bedrock and would continue to expose additional bedrock potentially housing additional paleontological resources. Potential for surface disturbance of exposed bedrock would occur through continued grazing and dispersed recreation as well as mining and other construction activities outside of NFS lands.

3.12.2.2. **Alternative 2 – Proposed Action**

Direct and Indirect Effects

Identified paleontological resources contained common elements that were determined to be of low scientific significance and a finding of **no significant adverse effect** has been made for paleontological resources on NFS lands affected by the proposed project. Potential occurs for additional buried resources to be affected within the proposed disturbance area. Fossils of scientific significance could be present within the project area but not exposed at the surface. Under the Proposed Action, some of those paleontological resources would be destroyed when overburden is removed.

The following project design criteria will be employed: The discovery of any and all fossils as the result of operations associated with the proposed project shall immediately

be brought to the attention of the District Ranger. The authorized user shall cease operations until authorized to proceed by the District Ranger.

Cumulative Effects

Weathering processes would continue on exposed bedrock and would continue to expose additional bedrock, potentially affecting paleontological resources. Cumulative impacts to paleontological resources would result mainly from extensive coal extraction activities within the vicinity of the project area. Some alterations to surface topography from construction may result from additional exploration and development near that area, as well. Surface disturbance associated with these activities could result in some permanent loss of paleontological information. Additional resources may continue to be discovered and/or destroyed as a result of mineral extraction surrounding the project area; however, this is unlikely if Grassland Plan Standard and Guidelines are followed and appropriate project design criteria are employed.

Irreversible and Irretrievable Commitments of Resources

An irreversible commitment would occur in the form of disturbance of non-significant paleontological features. No irretrievable impacts to paleontological resources are expected from the Proposed Action Alternative.

3.13. Cultural Resources

3.13.1. Affected Environment

The project area encompasses rolling grasslands, a ridge system skirted by heavily dissected foothills, and portions of Little Thunder Creek, North Prong Little Thunder Creek, and Burning Coal Draw drainages and associated unnamed tributaries. The ridges are characterized by steep slopes and narrow crests with exposed sandstone and scoria outcrops or broken and weathered unconsolidated rock just above bedrock. Little Thunder Creek and North Prong Little Thunder Creek hold water for a portion of the year under average rainfall conditions, and the confluence of the two is the nearest and most substantial source of seasonal surface water. The major bedrock underlying the project area is comprised of sedimentary rocks from the Lower Tertiary Period dominated by the Paleocene Fort Union Formation with minor exposures of the Eocene Wasatch Formation (Love and Christiansen 1985). Soil deposits consist primarily of alluvial deposits derived from sandstone and various shales outside of the portion of the ridge system where soils are shallow to nonexistent. Principle landscape features within the area consist of the steep, dissected ridge systems bisected by Little Thunder Creek.

Stable, intact, alluvial deposits containing stratified silt, clay, and sandy loams occur along the main channel and tributaries of Little Thunder Creek and North Prong Little Thunder Creek. Shallow eolian deposits exposed by erosion were observed on the lee side of some ridges. The greatest potential for buried cultural materials occurs within the alluvial terraces and eolian accumulations. Shallow, deflated alluvial loams intermixed with regolith or channery sediment deposits were observed across ridge tops and slopes, with many areas of exposed sandstone and scoria bedrock occurring throughout the project area. The inclusion of the major ridge system and surrounding foothills, uplands,

lowlands, drainages and transitions provided many opportunities to observe sediments and rule out the occurrence of subsurface archaeological deposits.

The National Historic Preservation Act of 1996, as amended (NHPA), sets forth national policy and procedures regarding historic properties defined as districts, sites, buildings, structures, and objects included in or eligible for the National Register of Historic Places (NRHP). Section 106 of NHPA requires Federal agencies to take into account the effects of their undertakings on such properties following regulations in 36 CFR 800 – Protection of Historic Properties.

Cultural resources, which are protected under the National Historic Preservation act of 1966, are non-renewable remains of past human activity. The Powder River Basin (PRB), including the general Thunder Basin Coal Company's proposed scoria mine permit area, appears to have been inhabited by aboriginal hunting and gathering people for more than 13,000 years. Throughout the prehistoric past, the area was used by highly mobile hunters and gatherers who exploited a wide variety of resources. Several thousand cultural sites have been recorded within the PRB.

Frison's (1978, 1991) chronology for the Northwestern Plains divides occupations from early to late into the Paleoindian, Early Plains Archaic, Middle Plains Archaic, Late Prehistoric, Late Prehistoric and Protohistoric periods. These periods are defined by the years before the present time (B.P.). Frison's chronology is listed below. The Plains designation within the Early, Middle, and Late Archaic periods has been omitted from the list.

- Paleoindian period (13,000 to 7,000 years B.P.)
- Early Archaic period (7,000 to 5,000-4,500 years B.P)
- Middle Archaic period (5,000-4,500 to 3,000 years B.P.)
- Late Archaic period (3,000-to 1,850 years B.P.)
- Late Prehistoric (1,850-400 years B.P.)
- Protohistoric Period (400-250 years B.P.)
- Historic Period (250 to 120 years B.P)

The Paleoindian period dates from about 13,000 to 7,000 years ago and includes various complexes (Frison 1978). Each of these complexes is correlated with a distinctive projectile point style derived from a general large lanceolate and/or stemmed point morphology. The Paleoindian period is traditionally though to be synonymous with "big game hunters" who exploited megafauna such as bison and mammoth (plains Paleoindian groups), although evidence of the use of vegetal resources is noted at a few Paleoindian sites (foothill-mountain groups).

The Early Archaic period dates from the 7,000 to 5,000-4,500 years ago. Projectile point styles reflect the change from large lanceolate types that characterize the earlier Paleoindian complexes to large side- or corner-notched types. Subsistence patterns reflect exploitations of a broad spectrum of resources, with a much-diminished utilization of large mammals.

The onset of the Middle Archaic period (4,500 to 3,000 years B.P.) has been defined on the basis of the appearance of the McKean Complex as the predominant complex on the Northwestern Plains around 4,900 years B.P. (Frison 1978, 1991, 2001). McKean Complex projectile points are stemmed variant of the lanceolate point. These projectile point types continued until 3,100 years B.P. when they were replaced by a variety of corner-notched points (i.e., Pelican Lake points) (Martin 1999). Sites dating to this period exhibit a new emphasis on plant procurement and processing.

The Late Archaic period (3,000 to 1,850 years B.P.) is generally defined by the appearance of corner-notched dart points. These projectile points dominate most assemblages until the introduction of the bow and arrow around 1,500 years B.P. (Frison 1991). The period witnessed a continual expansion of occupations into the interior grasslands and basins, as well as the foothills and mountains.

The Late Prehistoric period (1,850 to 400 years B.P.) is marked by a transition in projectile point technology around 1,500 years B.P. The large corner-notched dart points characteristic of the Late Archaic period are replaced by smaller corner- and side-notched points for use with the bow and arrow. Around approximately 1,000 years B.P., the entire Northwestern Plains appears to have suffered an abrupt collapse or shift in population (Frison 1991). This population shift appears to reflect a narrower subsistence base focused mainly on communal procurement of pronghorn and bison.

The Protohistoric period (400 to 250 years B.P.) witnesses the beginning of European influence on prehistoric cultures of the Northwestern Plains. Additions to the material culture include most notably the horse and European trade goods, including glass beads, metal, and firearms. Projectile points of this period include side-notched, tri-notched, and unnotched points, with the addition of metal points. The occupants appear to have practiced a highly mobile and unstable residential mobility strategy.

The Historic period (250 to 120 years B.P.) is summarized from Schneider et al. (2000). The use of the Oregon Trail by emigrants migrating to the fertile lands of Oregon, California, and the Salt Lake Valley brought numerous pioneers through the state of Wyoming, but few stayed. It was not until the fertile land in the West became highly populated, along with the development of the cattle industry in the late 1860s, that the region currently comprising of the state of Wyoming became attractive for settlement. The region offered cattlemen vast grazing land for the fattening of livestock, which could then be shipped across the country via the recently completed (1867-1868) Transcontinental railroad in southern Wyoming.

The settling of the region surrounding Gillette, Wyoming began in the late 1800s after a government treaty in 1867 placed the Sioux Indians on reservations outside the territory. Cattlemen were the first settlers to establish themselves in the area, followed by sheep herders, with dry land farmers entering the area after 1900. The town of Gillette was established by the railroad in 1891 in an effort to promote the settling of undeveloped areas along their rail lines. The presence of the railroad allowed for the greater development of the cattle industry because it facilitated shipping cattle from the area. Several early ranches established in the region include the 4J Ranch (1875), Half Circle L Ranch (1880s), I Bar U Ranch (1888), and the T7 Ranch (1881). Early ranches

established in the region surrounding the general TBCC Scoria Mine Permit area as of 1883 including the Ritchie Ranch, The McCray Ranch, and the 6 Ranch. Later arrivals to the area (as of 1908) include the Grant Ranch on Hay Creek, the Rooney Ranch on Rawhide Creek, and the Gardner and Wilson Ranches on the Little Powder River.

The Dry Land Farming movement of the late 19th and early 20th centuries had a profound effect on the settlement of the PRB during the years around World War I. Although the principles of dry land farming were sound, success still required a certain amount of precipitation each year. Wyoming encouraged dry land settlement of its semi-arid lands through a Board of Immigration created in 1911. Newspapers extolled the virtues of dry land farming, and railroads conducted well-organized advertising campaigns on a nationwide basis to settle the regions through which they passed.

The most intensive period of homesteading activity in the Eastern PRB occurred in the late 1910s and early 1920s. Promotional efforts by the state and the railroads, the prosperous war years for agriculture in 1917 and 1918, and the Stock Raising Act of 1916 with its increased acreage (but lack of mineral rights) all contributed to the boom period. A large amount of land filings consisted of existing farms and ranches expanding their holdings in an optimistic economic climate. However, an equally large number of homesteaders had been misled by promotional advertising and were not adequately prepared for the experiences that awaited them in the PRB. It soon became apparent to the would-be dry land farmer that one could not make a living by raising only crops. Some were initially successful in growing wheat, oats, barley and other small grains, along with hay, alfalfa, sweet clover, and other grasses for the increased number of cattle. The drought in 1919 was followed by a severe winter. The spring of 1920 saw market prices fall. Those homesteaders who were not ruined by the turn in events often became small livestock ranchers and limited their farming to the growing of forage crops and family garden plots. Some were able to obtain cheap lands as it was foreclosed or sold for taxes. During the 1920s the size of homesteads in Wyoming nearly doubled. And the number of homesteads decreased indicating the shift to livestock raising (LeCompte and Anderson 1982).

With serious drought beginning in 1932, several federal actions were taken. In April 1932, Weston, Campbell, and Converse Counties were eligible for a drought relief program. The Northeast Wyoming Land Utilization Project began repurchasing the sub-marginal homestead lands and making the additional acres of government land available for lease. This helped the small operator to expand the usable grazing land. Cropland taken out of production could be reclaimed and then added to the grazing lease program. Grazing associations were formed to regulate the grazing permits. In 1934, the Agricultural Adjustment Administration began studying portions of Converse, Campbell, Weston, Niobrara, and Cook counties. In all, 2 million acres, including about 500,000 acres of federal lands, were included in the Thunder Basin Project (LA-WY-1) to alter land used and relocate settlers onto viable farmland. Nationally, the program hoped to shift land use from farms to forest, parks, wildlife refuges or grazing districts. In marginal areas cash crops were to be replaced by forage crops, the kind and intensity of grazing would be changed and the size of operating units would be expanded (USFS n.d.). Land purchase work on the Thunder Basin Project began late 1934 and the purchasing of units started in 1935.

During the development program to rehabilitate the range impounding dams were erected, wells were repaired, springs developed, and homestead fences were obliterated while division fences were constructed for the new community pastures. Farmsteads were obliterated and the range reseeded. Remaining homesteaders and ranchers often purchased or scavenged materials from the repurchased farmsteads. Pits were dug on some homesteads and machinery and demolished buildings buried (many of these were dug up during World War II by scrap divers). Ironically, the rehabilitation project utilized a labor pool of former farmers who had spent years building what the government paid them to destroy. Their efforts were so successful that almost no trace remains of many homesteads.

While counties lost much of their population base as a result of the Resettlement Administration relocation program, they were strengthened financially: schools were closed, maintenance of rural roads was restricted to main arterioles, and delinquent taxes were paid. The remaining subsidized ranges were significantly larger and provided a stabilizing effect on the local economies. Three grazing associations were formed: the Thunder Basin Grazing Association, the Spring Creek Grazing Association, and the Inyan Kara Grazing Association. These associations provided responsible management of the common rangeland.

Class III Cultural Resources Surveys

A Class III cultural resources survey is an intensive and comprehensive inventory of a proposed project area conducted by professional archaeologists and consultants. The Survey is designed to locate and identify all prehistoric and historic cultural properties 50 years and older that have exposed surface manifestations. The goal of the survey is to locate and evaluate for the National Register of Historic Places (NRHP) all cultural resources within the project area. Cultural properties are recorded at a sufficient level to allow for the evaluation for the possible inclusion to the NRHP. Determinations of eligibility are recorded at a sufficient level to allow for evaluation for the possible inclusion for the NRHP. Determinations of eligibility are made by the managing federal agency in consultation with the State Historic Preservation Office (SHPO). Consultation with the SHPO must be completed prior to the approval of the mining plan.

After completion of a Class III cultural resources survey, additional investigations may be undertaken to complete an individual site record. If necessary, site specific testing or limited excavation may be utilized to collect additional data which will: 1.) determine the final evaluation status of a site; and/or 2.) form the basis of additional work to be conducted during the implementation of a treatment plan if the site is determined *eligible* for the NRHP. A treatment plan is then developed for those sites that are *eligible* for the NRHP and are within the area of potential effect (APE). Treatment plans are implemented prior to mining and can include such mitigation measures as avoidance (if possible), large scale excavation, complete recording, Historical American Building Survey/Historical American Engineering Record documentation, archival research, and other acceptable scientific practices.

3.13.1.1 Thunder Basin Coal Company Scoria Mine

Cultural resource inventories in this area began in the early 1980s and continued with numerous projects associated with oil and gas field development as well as surface mining operations, throughout the 1990s and 2000s. The intensive (Class III) cultural resource inventory was conducted by ARCADIS U.S. Inc. on behalf of the Thunder Basin Coal Company (TBCC) in approximately 50% of the area of potential effect (APE). The proposed permit area has been determined as 2,880 acres and includes 1,022 acres of the entire area (private, federal, and state lands) within which development, operation, and maintenance of the proposed undertaking may impact cultural resources.

During the course of this survey 11 new sites were discovered, and 19 previously recorded sites were revisited and updated. Of the total number of archaeological sites recorded 22 are prehistoric, 7 are historic, and 1 is a multi-component sites consisting of both prehistoric and historic elements. Prehistoric sites consist primarily of lithic scatters, cairns, stone circles, and campsites. Historic sites consist primarily of historic rock cairns, inscriptions, historic dams, trash scatters, and windmill debitage. The Forest Service has determined that 10 previously recorded sites lie within the permit boundary and 4 newly recorded sites for a total of 14 sites that are determined *eligible* for the National Register of Historic Places. One (1) site needs additional testing to make a determination of eligibility; therefore it remains as *unevaluated* for its potential inclusion to the NRHP. All sites that are eligible and unevaluated for the NRHP will be avoided during all mineral extraction activities.

3.13.2. Environmental Consequences

3.13.2.1. Alternative 1 – No Action

Direct and Indirect Effects

No mining would be initiated on NFS lands with the project area under the No Action Alternative, so cultural resources would be affected. Potential for mining on adjacent private lands would remain.

Cumulative Effects

Weathering processes would continue on exposed sites and potential for surface disturbance of localities would occur through continued grazing and dispersed recreation as well as mining and other construction activities outside of NFS lands.

3.13.2.2. Alternative 2 – Proposed Action

Direct and Indirect Effects

The USFS will complete consultation with the SHPO prior to approval of the mining plan. At that time, those sites determined *eligible* or *unevaluated* for the NRHP through consultation would receive further protection or treatment.

Impacts to *eligible* or *unevaluated* cultural resources shall not be permitted. It is the Forest Service's recommendation that all *eligible* and *unevaluated* sites be avoided during all mining activities within the permit boundary. If *unevaluated* sites cannot be

avoided, they must be evaluated prior to disturbance. If *eligible* sites cannot be avoided, a data recovery plan must be implemented prior to disturbance. The lead federal and state agencies would consult with the Wyoming SHPO on the development of any testing, mitigation, or data recovery plans and the manner in which these plans are carried out. Sites that were determined as *not eligible* cultural sites may be destroyed without further work.

Cultural resources adjacent to the mine areas may be impacted as a result of increased access to the areas. There may be increased vandalism and unauthorized collecting associated with recreational activity and other pursuits outside but adjacent to mine permit areas. Unintended or uninformed impacts related to off-road traffic outside of but adjacent to mine permit areas during mine related activities are the most frequent impacts to cultural resources.

Potential occurs for buried resources to be affected within the proposed disturbance area. Forest policy (USFS 2002) requires that the discovery of any and all cultural features identified as the result of operations under the mine plan shall immediately be brought to the attention of the District Ranger. The permittee shall cease operations at the site of discovery until authorized to proceed by the District Ranger.

Cumulative Effects

Weathering processes would continue on exposed bedrock and would continue to expose additional bedrock, potentially affecting cultural resources. Potential for surface disturbance of exposed bedrock would occur through continued grazing and dispersed recreation as well as mining, oil and gas development, road construction, and other surface disturbances.

Irreversible and Irretrievable Commitments of Resources

An irreversible commitment could occur in the form of disturbance of non-significant cultural resources. No irretrievable impacts to cultural resources are expected from the Proposed Action Alternative.

3.14. Fire and Fuels

3.14.1. Affected Environment

The project area supports various vegetation communities providing differing types and quantities of vegetation and associated fuel loads on terrain varying from flat to steep. Vegetation communities on NFS lands are classified as Mixed Grass Prairie, Bunchgrass, Crested Wheatgrass, Big Sagebrush Shrubland and Rough Breaks. Greasewood shrubland and Silver Sagebrush additionally occur on private lands. The first three referenced communities are herbaceous and provide ground cover to stabilize soils. Shrub areas are similar, with the added element of woody material associated with shrubs. Rough Breaks areas support very low vegetation cover and high bare soil/rock areas. Areas of dense cheatgrass also occur, primarily within portions of the Bunchgrass communities.

Fuel Models

Fuel models group similar vegetation types for predicting fire and are grouped according to the primary fuel carrying the fire. Fuel models address the following fuel types: Non-burnable (NB), Grass (GR), Grass-shrub (GS), Shrub (SH), Timber-understory (TU), Timber-litter (TL), and Slash-blowdown (SB) (Scott and Burgan 2005). Geospatial fuel model data for the project area indicated primary occurrence of fuel models GR2, GS2, and NB9 (USGS 2010).

Fuel model GR2 represents moderately coarse continuous grass community with an average height of approximately one foot, a high spread rate, and moderate flame length. Flame length and rate of spread is dynamic and will vary according to fuel moisture and wind speed. The GR2 vegetation types within the project area consist of Mixed Grass Prairie, Crested Wheatgrass, and Bunchgrass communities.

Fuel model GS2 represents communities with shrubs from 1-3 feet in height with an herbaceous understory providing a moderate fuel load. Spread rate is high, and flame length is moderate. Flame length and rate of spread is dynamic and will vary according to fuel moisture and wind speed. The primary GS2 vegetation type inside the project area consists of Big Sagebrush.

Fuel model NB9 represents land lacking sufficient fuel to support wildland fire spread. The NB9 areas within the project area primarily consist of Rough Breaks and scoria rock outcrop area inclusions.

Fire History

Wildfires on the northern plains were large and frequent prior to European settlement. The primary sources of ignition were lighting and intentional burning by Native Americans. Active and passive fire suppression associated with European settlement has resulted in smaller fires, on average. This has increased the fire interval in many areas resulting in a shift in vegetation types, thus setting the stage for large, catastrophic fires (Perryman 2001).

The increase in fire interval had a direct effect on the Wyoming big sagebrush (*Artemisia tridentata* spp. *wyomingensis*) communities. These communities are very sensitive to fire because sagebrush reestablishment is dependent solely upon seed banks and seed dispersal from adjacent unburned populations; recruitment is episodic. The decrease in fire-affected areas has resulted in an increase in sagebrush occurrence and maturity (Perryman 2001).

The introduction of cheatgrass (*Bromus tectorum*) has also played a role in the fire environment of the area. Cheatgrass is an early season annual grass that matures and cures early in the fire season. The finely divided plant structure, high density of plants, early season curing, and litter accumulation common in cheatgrass stands can create a continuous fuel bed conducive to rapid fire spread. After a fire, cheatgrass reestablishes from the seed bed and may out-compete native perennial vegetation, creating an ecosystem favoring increased fire frequency (USFS 2000).

Fire Regime

The average fire interval for the Northern Mixed Grass Prairie, which is representative of the project area, is identified by the USFS (2011) as 15 years as presented in Table 28. Replacement severity fires are most common, occurring in a range of 8-25 years, with a lesser occurrence of mixed severity fires with a maximum 35-year fire interval.

Table 25: Northern Mixed Grass Prairie Fire Interval

Fire Severity	% of Fires	Mean Interval	Minimum Interval	Maximum Interval
Replacement	67	15	8	25
Mixed	33	30	15	35

Replacement severity references any fire that causes greater than 75% top removal of a vegetation-fuel type, resulting in general replacement of existing vegetation and may or may not cause a lethal effect on the plants. Mixed severity fires reference any fire burning more than 5% of an area that does not qualify as a replacement, surface, or low-severity fire and includes mosaic and other fires that are intermediate in effects. Surface or low severity fires cause less than 25% upper layer replacement and/or removal in a vegetation-fuel class but burn 5% or more of the area.

Specific studies in the nearby Rochelle Hills of the TBNG indicate fire regimes ranging from 1-24 years, with an average of 7.4 years (Perryman 2001). However, this area includes timber that is lacking in the project area.

According to the Interagency Fire Regime Condition Class Guidebook (Hann et al. 2010), the natural fire regime is a general classification of the role fire would play across the landscape in the absence of human intervention. Five fire regimes have been identified as presented in Table 29; each is determined by frequency and severity and is related to the types of vegetation on the landscape.

Table 26: Fire Regimes

Fire Regime Group	Frequency (Fire Return Interval)	Severity
I	0-34 years	Low/mixed
II	0-34 years	Stand replacement
III	35-200 years	Mixed/low
IV	35-200 years	Stand replacement
V	>200 years	Stand replacement/any

The effects of fire are related to dominant cover species. The vegetation type mapped within the analysis area is Plains Grassland (USFS 2000). Plains Grasslands are classified in Fire Regime Group II, with 0-34 year fire return intervals and stand replacement fire severity. When dry, this vegetation type provides fuels ideally suited for burning that typically fall into the fine fuels category. However, the compact arrangement of bunchgrasses makes portions of these plants difficult to ignite regardless of dryness. Plant density, inclusion of shrub species, and overall geometry of the stand also affect a location's ability to carry fire.

Wildland fire extent and severity are affected by fuel load and continuity as well as fuel moisture levels.

Condition Class

The fire regime condition class (FRCC) is a qualitative measure describing the degree of departure from historical fire regimes (Hann et al. 2010, Menakis 2003) as indicated in Table 30. On a project scale the FRCC is dynamic and will vary across the landscape.

Table 30: Fire Regime Condition Class

Fire Regime Condition Class*	
FRCC I	Fire regimes are within a historical range and the risk of losing key ecosystems is low
FRCC II	Fire regimes have been moderately altered from their historical range and the risk of losing key ecosystems is moderate. Fire frequencies have changed by one or more return intervals, resulting in changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range.
FRCC III	Fire regimes have been significantly altered from their historical range and the risk of losing key ecosystems is high. Fire frequencies have changed by multiple return intervals, resulting in dramatic changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range.

*Adapted from Menakis et al.

The introduction of cheatgrass, fire suppression, area mining activities, and varying grazing practices have created a mosaic of potential fire regimes across the project area. The Northern Mixed Grass Prairie fire interval of 0-35 years primarily of stand replacement severity, inclusion of GR2 and GS2 fuel models, and inclusion of cheatgrass areas within the project area, as well as increased human activity related to mining, affects the dynamics of the FRCC.

3.14.2. Environmental Consequences

3.14.2.1. Alternative 1 – No Action

Direct and Indirect Effects

Under the No Action Alternative, mining would not be initiated on NFS lands, and no direct or indirect affects will occur to fire or fuels on those lands. Potential for mining would remain on private lands.

Cumulative Effects

Under this alternative, fuel models and fire return intervals would continue to progress at the current rate. Fire suppression will continue to limit fire extent under most circumstances. Fire suppression has generally been recognized to increase fuel load, particularly in GS2 models. Fuel load also increases in GR2 models with existing dense cheatgrass areas. Fire suppression in areas that do not currently support dense cheatgrass

stands may result in a favorable advantage to native grasses, increase the fire return interval, and reduce the competitive advantage of cheatgrass post fire.

Mining, grazing, and railroad transport would continue in the surrounding area affecting the potential for human-induced (direct or from sparks related to equipment or railroad use) fires and changes in cheatgrass occurrence and vegetative fuel loads.

3.14.2.2. Alternative 2 – Proposed Action

Direct and Indirect Effects

Immediate and short term effects of the proposed action would be a decrease in grass and grass-shrub fuel areas and an increase in non-burnable (bare) fuel areas. Range fire scale and intensity would decrease as a result of decreased fuel volume and continuity within the project area.

Cumulative Effects

As reclamation and reseeding establishes a self-sustaining vegetation community, the fuel model will progress from non-burnable to grass or grass-shrub. During the initial and intermediate phases of the re-vegetation process, fuel loads and continuity would be more homogenous over larger sections of the project area and possibly greater than pre-mine conditions. Range fire frequency potential would be expected to increase to or above pre-disturbance intervals. However, reclamation and disturbance will be incremental, creating more of a non-burnable mosaic than pre-mine conditions. Fire suppression activities would be conducted as part of the proposed action, and observation levels would be enhanced over pre-mine conditions. The post mining community would be expected to return to a mosaic of grass and grass-shrub fuel models with grass-shrub model reestablishment dependent largely on the seeding success of shrubs.

Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable impacts to fire and fuels are expected from the Proposed Action Alternative.

3.15. Socioeconomics

Total recoverable project area clinker reserves are estimated at approximately 24,721,049 bank cubic yards (bcy) with 13,082,999 bcy occurring on NFS lands and 11,638,050 bcy occurring on private lands. The clinker would be used by TBCC for road maintenance and construction material in the Black Thunder TEAL Amendment Permit Area to allow continued mining operations. Although individuals and communities from a wide geographic area use NFS land resources, the analysis area for this section is defined as the Campbell County portion of the PRB within which the project area is located.

3.15.1. Affected Environment

During 2011 coal mines in the area produced 426.4 million tons of coal, up by 3.2 million tons from 2010 (USDILBLM 2012). Wyoming's 19 coal mines employed 6,869 personnel

in 2010, 5,416 of which were employed in Campbell County (WMA 2010). The region also supports extensive agriculture.

The examination of population trends is vital to the understanding of the overall nature of an area. The use and occupation of lands in Campbell County has been increasing due to energy development in the form of coal mining, uranium mining, and oil and natural gas development. Gillette and Wright are the largest communities in the vicinity of the project area. The City of Gillette calls itself “The Energy Capital of the Nation” (Campbell County Chamber of Commerce 2012). According to the U.S. Census Bureau, Campbell County’s population was 46,133 in 2010, indicating a 36.9% growth in population from 2000 to 2010 (USCB 2010).

The PRB supplies approximately 40 percent of the Nation’s coal and is the single largest source of coal mined in the United States (USDOE 2007, WMA 2010). The median house hold income in 2009 for Campbell County was \$78,797 (USCB 2010). Approximately 49 percent of the first quarter 2011 total employment in Campbell County was attributed to mining, quarrying, and oil and gas extraction. Campbell County employment grew at a rate of 1.83 percent between first quarter of 2010 and the first quarter of 2011 (WYDOE 2011). According to the Wyoming Department of Workforce Services, the unemployment rate for Wyoming as of December 2011 was 5.8 percent. This was lower than the National unemployment rate of 8.3 percent. According to the same report, Campbell County’s unemployment rate was at 4.2 percent (WYDOE 2012).

TBCC’s estimated demand for project area clinker reserves within the 5-year mining blocks ranges from 4,351,658 to 6,989,661 bcy. The maximum annual clinker need is estimated at 1.4 million bcy/year for a total of 7 million bcy per 5-year period. The difference between the identified project area volumes and total volume required is addressed by remaining clinker reserves within the Black Thunder TEAL Amendment Permit Area Boundary. The expected life of the Proposed Project, not including final reclamation, is expected to be 21 years based in maximum estimated clinker needs. See Figure 3: Proposed Mining Sequence for the proposed mining sequence.

Expenses to TBCC for mining clinker on private and NFS lands are shown in Table 28 to include permitting, mining, reclamation, royalty payments and severance tax costs estimated by TBCC to be \$5.44/bcy. State and Federal Revenues in the form of Royalty payments and Severance taxes generated from the mining operations are estimated by TBCC to be \$1.00/bcy. The cost to purchase clinker from an independent source is estimated by TBCC to be \$13.25/bcy, per independent contractor quote.

NFS lands within the project area are expected to provide 13,082,999 bcy of minable clinker. At the costs identified in Table 31: Clinker Mining Revenue/Expense Summary, total cost to mine this volume of clinker is estimated at \$71,171,513, while purchase of this volume of clinker from an independent contractor would cost \$173,349,733. The resulting cost difference between mining and purchasing NFS lands clinker is estimated as \$102,178,220.

Table 31: Clinker Mining Revenue/Expense Summary

Activity	Cost/bcy (\$)	Total Cost by Activity for Estimated Minable Clinker on NFS lands ¹ (\$)	Total Cost by Activity for Estimated Minable Clinker on Private Lands ² (\$)	Total Cost by Activity within Project Area (\$)
Permitting	\$0.05	\$654,150	\$581,903	\$1,236,052
Mining	\$3.84	\$50,238,715	\$44,690,112	\$94,928,827
Reclamation	\$0.55	\$7,195,649	\$6,400,928	\$13,596,577
Royalty	\$0.70	\$9,158,099	\$8,146,635	\$17,304,734
Severance Tax	\$0.30	\$3,924,900	\$3,491,415	\$7,416,315
Total:	\$5.44	\$71,171,513	\$63,310,992	\$134,482,505
Cost to purchase ³	\$13.25	\$173,349,733	\$154,204,163	\$327,553,895
Savings to Mine ⁴	\$7.81	\$102,178,220	\$90,893,171	\$193,071,390

Table calculations based on information provided by TBCC.

¹Total Estimated Minable Clinker on NFS lands is 13,082,999 bcy.

²Total Estimated Minable Clinker on Private Lands is 11,638,050 bcy.

³Cost to purchase clinker from independent contractor.

⁴Savings to mine of mining clinker on project area over purchasing from independent contractor.

Private lands within the project area are expected to provide 11,638,050 bcy of minable clinker. At the costs identified in Table 31, total cost to mine this volume of clinker is estimated at \$63,310,992, while purchase of this volume of clinker from an independent contractor would cost \$154,204,163. The resulting cost difference between mining and purchasing private lands clinker is estimated as \$90,893,171.

3.15.2. Environmental Consequences

3.15.2.1. Alternative 1 – No Action

Direct and Indirect Effects

Under Alternative 1 no activity would be undertaken by the project proponent under the Proposed Action. USFS management practices would continue on NFS lands. TBCC would continue to actively mine their privately owned and leased properties in the surrounding area. No minerals would be produced from NFS lands, so the general public would not receive benefits from such production, continued employment opportunities, and royalty or severance tax revenues. There would be no direct significant effects to the lands other than being surrounded by mining activities. Potential would remain for mining to occur on private lands.

Existing minable road construction and maintenance material deposits are limited within areas currently permitted for mining. Under Alternative 1, clinker or other road construction material will need to be obtained from a new permit area or purchased and trucked or otherwise imported from other locations to maintain coal production under existing and pending Federal coal leases. The No Action Alternative would impact

production and cost of production of the adjacent coal resource. Cost studies show that purchasing clinker from other mining operators in the area would cost TBCC over forty percent more than the Proposed Action over the short term (per Table 28).

Cumulative Effects

Although the project area would not directly be affected by mining activities, TBCC is actively mining coal to the north, west and south of the project area. Clinker procurement would be required from another source equivalent to that of the Proposed Action. The increased traffic and noise due to hauling clinker from other sources would affect the quality of life for residents living near the project area.

3.15.2.2. Alternative 2 – Proposed Action

Direct and Indirect Effects

Under the Proposed Action, TBCC would utilize current employees and mining equipment from the Black Thunder TEAL Amendment Permit Area for the mining activities. These employees and resources would be involved in truck hauling, crushing and site maintenance. TBCC is expected to pay approximately \$58,088,514 for Environmental Permitting, Mining and Reclamation activities on NFS lands. Additional jobs in the community and elsewhere would support and benefit from these proposed mining operations.

Since TBCC plans to use all the mined scoria in their neighboring coal mining operations, no clinker revenues to TBCC are anticipated. Project area savings to TBCC from mining NFS lands over purchase from another source are estimated at \$102,178,220. Severance Taxes from the mined resource are expected to generate \$3,924,900 while Royalty Payments are expected to generate \$9,158,099 between 2015 and 2035 per Table 31.

The mining activities proposed under this action would have a small effect on the quality of life for residents living near the project area. The increased noise, dust, traffic and visual effects would be minimal compared with the current coal mining activities currently surrounding the project area. No blasting is proposed within the project area under this proposed action.

The project area would be fenced, gated off and signed to reduce public safety hazards associated with the mining operation, per requirements of the Mine Safety and Health Administration (MSHA). The site would be locked during non-operating periods. Signs identifying the site as a mine would be conspicuously placed on the perimeter of the site at regular intervals. Access to the site would be restricted to mine employees and authorized personnel only and would require access through the mine's main security gates. Additional security measures as required by Federal, State and Local law would be used.

Visitors to the public lands by local and non-local residents for recreational activities including hunting, hiking, target shooting, wildlife viewing and camping is limited due to

current mining activities. The area would be temporarily closed to the public during mining and reopened after final reclamation is completed.

The proposed action is consistent with the Thunder Basin National Grassland Land and Resource Management Plan which emphasizes the effective and efficient removal of mineral resources concurrent with other ongoing resource uses and activities.

Cumulative Effects

To the north, west and south of the project area, TBCC is actively mining for coal and scoria. Current noise and dust sources in the project area are primarily associated with these coal and scoria mining operations, oil and gas production, haul roads, blasting operations on nearby coal mines, traffic on Highway 450 and train traffic on the Burlington Northern Santa Fe railroad. The project area is adjacent to private property, much of which will be mined for scoria and coal by TBCC. The effects of increased traffic and noise is likely to continue regardless of whether this project occurs because of the close proximity of existing coal mining operations.

The Proposed Action would ensure that viable coal mining operations have the needed scoria to maintain their long-term mining activities from a local natural resource. Long term employment and economic stability would be secured. Tax revenues would be generated by the extraction of the resource in an area already heavily developed by other mining activities.

Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable impacts to socioeconomics are expected from the Proposed Action Alternative.

Short-term Uses and Long-term Productivity _____

NEPA requires consideration of “the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity” (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and to fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Short term uses are those expected to occur on the Forest during the next ten years. These include, but are not limited to; recreational use, grazing, and mineral development. Long-term productivity refers to the capability of the land to provide resource outputs beyond the 10-year period.

Topography, Geology, and Overburden

No long term losses to productivity would occur from the No Action Alternative. The Proposed Action Alternative would result in more subtle and slightly lower topography in some areas, removal of the clinker resource, and redistribution of some overburden. Topography would be replaced to the approximate pre-mine conditions

during the reclamation process through re-distribution of overburden. Geologic processes would continue, but the removed clinker would not be replaced in the foreseeable future.

Air Quality

Short term effects to air quality would occur under either alternative, as clinker mining is expected to continue to ensure uninterrupted coal mining of Federal coal leases, whether the clinker mining occurs within project area NFS lands or elsewhere. There is no expected loss in long term productivity from the proposed action alternative. There may be an increase under the no action alternative due to the face of increased emissions from vehicle traffic hauling longer distances.

Climate and Meteorology

There is no expected loss in long term productivity from the proposed action alternative. There may be an increase under the no action alternative due to the face of increased emissions from vehicle traffic hauling longer distances.

Water Resources

No long term losses would occur from the No Action Alternative. Long term losses to groundwater recharge contributions may occur as a result of clinker removal during the Proposed Action, but no long term loss would be expected to occur to surface water or water rights because affected areas would be re-established.

Soils

No long term loss in soil productivity is expected under either alternative. Soils would be modified under the Proposed Action Alternative, but long term productivity would be re-established through the reclamation process and continual soil development processes.

Vegetation and Botany

No long term loss in vegetation or botany productivity is expected under either alternative. The seral stage, vegetation community composition, and ratio of vegetation communities would be modified under the Proposed Action Alternative, but long term productivity would be re-established through the reclamation process.

Areas of Sensitive and Species of Local Concern habitat and a portion of one Species of Local Concern population would be lost under the Proposed Action but species viability is not expected to be affected, and the action is not expected to cause a trend toward federal listing.

Wetlands

There is no expected loss in long term productivity from either alternative. Short term losses would occur under the Proposed Action but would be re-established during the reclamation process.

Wildlife and Aquatics

Short term impacts to individuals may occur under either alternative. Long term loss of productivity may occur to Management Indicator Species under either alternative.

Land Use and Recreation

There is no expected loss in long term productivity from either alternative. Short term losses in area available for these activities would occur under the Proposed Action but would be re-established through the reclamation process and associated removal of mining-related exclusion areas. Impacts to grazing will likely be longer than 10 years but anticipated to be minimal as possible due to the incremental nature of the proposed scoria removal.

Travel Management

There is no expected loss in long term productivity from either alternative. Short term losses in NFS roads and access would occur under the Proposed Action but would be re-established through the reclamation process and associated removal of mining-related exclusion areas.

Scenic Resources

There is no expected loss in long term productivity from either alternative. Short term alterations would occur under the Proposed Action but would be re-established during the reclamation process.

Paleontological Resources

There is no expected loss in long term productivity from either alternative including the Proposed Action if Grassland Plan Standard and Guidelines are followed and appropriate project design criteria are employed. Insignificant resources may be lost for the long term.

Cultural Resources

There is no expected loss in long term productivity from either alternative including the Proposed Action if Grassland Plan Standard and Guidelines are followed and appropriate project design criteria are employed.

Socioeconomics

Loss of short and long term economic productivity in the form of lost Federal and State revenue would occur under the No Action Alternative. Short and long term economic productivity would be realized in the form of Federal and State revenue under the Proposed Action Alternative.

Unavoidable Adverse Effects

Application of Grassland Plan standards and guidelines would limit the extent and duration of any adverse environmental effects associated with the project. However, some potential impacts are unavoidable with implementation of the Proposed Action as presented below. For further effects discussion by resource area, see Chapter 3.

Topography, Geology, and Overburden

Geology would be modified by removal of clinker during Alternative 2: Proposed Action.

Air Quality

Air quality would be adversely affected short term under either alternative, as clinker mining is expected to continue to ensure uninterrupted coal mining of Federal coal leases, whether the clinker mining occurs within project area NFS lands or elsewhere.

Climate and Meteorology

No unavoidable adverse effects are expected to occur from either action alternative.

Water Resources

Long term losses to groundwater recharge contributions may occur as a result of clinker removal under Alternative 2: Proposed Action.

Soils

Under Alternative 2: Proposed Action, alterations would occur in soil composition, structure, depth, and organic matter. Soil would be replaced and soils formation processes would continue, but soils would differ from pre-mining conditions.

Vegetation and Botany

Potential Sensitive and Species of Local Concern habitat would be removed by Alternative 2: Proposed Action and may not be restored. Individuals from one Species of Local Concern population would be removed.

Wetlands

Two wetland areas (playa and reservoir) would be removed for the short term.

Wildlife and Aquatics

Individuals may be adversely impacted short term under either alternative. Management Indicator Species may also be adversely impacted long term under either alternative.

Land Use and Recreation

Grazing and recreation would be adversely affected short term under Alternative 2: Proposed Action, as a portion of the project area would be unavailable such uses.

Travel Management

Travel would be adversely affected short term under Alternative 2: Proposed Action, as access to portions of the project area would be temporarily unavailable.

Scenic Resources

Scenic resources would be altered during the mining process and restored during the reclamation process to a condition similar to pre-mining conditions under Alternative 2: Proposed Action.

Paleontological Resources

No unavoidable adverse effects would occur to paleontological resources under either action alternative. If resources were to be identified as affected by mining, mitigation would be required.

Cultural Resources

No unavoidable adverse effects would occur to cultural resources under either action alternative. If resources were to be identified as affected by mining, mitigation would be required.

Fire and Fuels

No unavoidable adverse effects are expected to occur to the fire regime of fuel loads under either action alternative.

Socioeconomics

Unavoidable adverse effects would occur under Alternative 1: No Action due to interruption of coal mining of Federal coal leases and lost Federal and State revenues.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs “to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with ...other environmental review laws and executive orders.”

Consultation and disclosure completed by the Douglas Ranger District in association with the Proposed Action Alternative included the National Historic Preservation Act for causing ground disturbing actions in historical places.

CHAPTER 4. CONSULTATION AND COORDINATION

Preparers and Contributors

The USFS consulted the following individuals, Federal, State, and local agencies, tribes and non-USFS persons during the development of this draft environmental assessment:

List of Preparers

Interdisciplinary Team Leader: Amy Ormseth

Forest Service Specialists:

Air – Greg Eaglin
Aquatics – Shawn Anderson
Botany – Katie Haynes
Engineering – Anne Haverhaults
Fire/Fuels – Clay Westbrook

Minerals – Amy Ormseth
Heritage – Orrin Koenig
Hydrology – Carol Purchase
Lands/Realty – Geri Proctor
NEPA – Allen Hambrick
Paleontology – Peter Rose/Angela Bulla
Range – Moriah Shadwick
Recreation – Marcia Rose-Ritchie
Scenic – Jeff Tupala

Social and Economics – Allen Hambrick
Soils – Randy Tepler
Wildlife – Cristi Painter

Knight Technologies, Inc.

Craig Knight, Naomi Morton-Knight, Melody Smith, David T. Hill, Kris Anderson, Gretchen Romans, Corey Nestor, Peg Kolata, John Bridgewater

Arcadis U.S., Inc.

Adam Graves, Natalie Graves, Benjamin Shoup

Intermountain Resources

Jim Orpet, Rusty Tait

FEDERAL, STATE, AND LOCAL AGENCIES:

Bureau of Land Management - Buffalo Field Office
Campbell County Commissioners
Campbell County Economic Development Corporation
Converse County Commissioners
Converse County Fire Warden
Environmental Protection Agency, Region 8
Gillette Chamber of Commerce
Gillette Mayor Duane Evenson
Mayor, Town of Wright
Representative Cynthia Lummis
Senator John Barrasso
Senator Michael Enzi
United States Fish and Wildlife Service
USDI Office of Surface Mining
USFWS Buffalo Resource Area
Wyoming Business Council
Wyoming Department of Agriculture
Wyoming Department of Environmental Quality, Air Quality Division
Wyoming Department of Environmental Quality, Land Quality Division
Wyoming Department of Environmental Quality, Water Quality Division
Wyoming Department of Revenue
Wyoming Game and Fish Department

Wyoming Oil and Gas Commission
Wyoming Public Lands Council
Wyoming State Engineer
Wyoming State Geological Survey
Wyoming State Historic Preservation Office
Wyoming State Lands and Investments, Forestry Division
Wyoming State Planning Coordination Office
Wyoming State Planning Office
Wyoming State Representative Sue Wallis
Wyoming State Representative Thomas Lubnau
Wyoming State Representative Timothy Hallinan
Wyoming State Senator John Hines
Wyoming State Senator Michael Von Flatern
Wyoming Water Development Commission

TRIBES:

Blackfoot Nation
Cheyenne and Arapaho Business Council
Cheyenne and Arapaho Tribes
Cheyenne River Lakota Tribal Council
Crow Nation
Fort Peck Assiniboine and Sioux Tribes
Hunkpapa-Santee-Sioux
Lower Brule Sioux Tribe
Northern Arapaho Business Council
Northern Cheyenne Tribal Council
Northern Cheyenne Tribe
Oglala Sioux Tribe (attempted and returned)
Rosebud Sioux Tribe
Shoshone Business Council
Shoshone Cultural Committee
Standing Rock Lakota Tribal Council
Three Affiliated Tribes Business Council

OTHERS:

Biodiversity Conservation Alliance
BNSF Railway Company
Dan Tracy
Jacobs Coal
Medicine Wheel Coalition
Peabody Energy
Peabody Natural Gas, LLC (attempted but returned)
Powder River Basin Resource Council
Powder River Coal, LLC
Powder River Energy Corporation
Rio Tinto Energy America

Thunder Basin Coal Company
Thunder Basin Grasslands Prairie Ecosystems Association
Thunder Basin Grazing Association
Thunder Basin Resource Coalition
Wendell Funk
Wyoming Stockgrowers Association

CHAPTER 5. LITERATURE CITED

- Anderson, D.G. 2006. *Festuca hallii* (Vasey) Piper (Hall's fescue): A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region Species Conservation Program. Available online at: <http://www.fs.fed.us/r2/projects/scp/assessments/festucahallii.pdf> [10/17/2011].
- Anderson, D.G. and D. Cariveau. 2003. *Botrychium campestre* W.H. Wagner & Farrar (Iowa moonwort: A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region Species Conservation Program. Available online at: <http://www.fs.fed.us/r2/projects/scp/assessments/botrychiumcampestre.pdf> [10/17/2011].
- Beatty, B.L., W.F. Jennings, and R.C. Rawlinson. 2003 (November 12). *Botrychium ascendens* W.H. Wagner (trianglelobe moonwort), *B. crenulatum* W.H. Wagner (scalloped moonwort), and *B. lineare* W.H. Wagner (narrowleaf grapefern): A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region Species Conservation Program. Available online at: <http://www.fs.fed.us/r2/projects/scp/assessments/botrychiums.pdf> [10/17/2011].
- Bowen, C., G.E. Schuman, R. Olson, and L. Ingram. 2005. Influence of Topsoil Depth on Plant and Soil Attributes of Twenty-four Year Old Reclaimed Mined Land. *Arid Land Research and Management*. 19(3):267-284. Available online at: http://www.ars.usda.gov/research/publications/publications.htm?seq_no_115=172082
- Campbell County Chamber of Commerce. 2012. Website available online http://www.gillettechamber.com/our-community/do_business.aspx [5/3/2012].
- Clark, Shane. 2000. Weed Prevention Measures and Methods *In* Montana War on Weeds, Weed Control/Weed Prevention. Montana Weed Control Association Annual Meeting, 2008. Available online at: <http://mtwow.org/weed-prevention1.htm>

- Cowardin, L, V. Carter, F. Golet, and E. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. USDI Fish and Wildlife Service, Washington, D.C. FWS/OBS-79/31. 142 pp. Available online at: http://www.fws.gov/wetlands/_documents/gNSDI/ClassificationWetlandsDeepwaterHabitatsUS.pdf [12/01/2011).
- DiTomaso, J. 2000. Invasive Weeds in Rangelands: Species, Impacts, and Management. Weed Science Society of America. Weed Science 48(2):255-265. Available online at: <http://www.mendeley.com/research/invasive-weeds-in-rangelands-species-impacts-and-management/> [12/28/2011].
- Eathorne, F. 2001. Current Grazing Practices and the Relationship to Communities. Proceedings of the First Symposium of the Thunder Basin Grasslands Prairie Ecosystem Association, pp. 143-147. Available online at: <http://www.rswyoming.com/TBGPEA/pdf%20files/FirstSymposium/AssnFirstSymWebDoc15.pdf>.
- Environmental Laboratory. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0). Wetlands Regulatory Assistance Program ERDC/EL TR-10-3. U.S. Army Engineer Research and Development Center. Vicksburg, MS. 141pp.
- Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual, Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Station. Vicksburg, MS. 143pp.
- Executive Order No. 11990, Protection of Wetlands. May 24, 1977. 42 F.R. 26961. Available online at: <http://water.epa.gov/lawsregs/guidance/wetlands/eo11990.cfm>.
- Fertig, W. 2000. Status review of the Ute ladies' tresses (*Spiranthes diluvialis*) in Wyoming. Report prepared for the Wyoming Cooperative Fish and Wildlife Research Unit, US Fish and Wildlife Service, and Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, WY. Available at: <http://uwadmnweb.uwyo.edu/WYNDD/> [10/17/2011].
- Flores, R.M., A.M. Ochs, L.R. Bader, R.C. Johnson, and D. Vogler. 1999. Framework Geology of the Fort Union Coal in the Powder River Basin, Wyoming and Montana. Chapter PF, pages 1-40, in Fort Union Coal Assessment Team. In: 1999 Resource Assessment of Selected Tertiary Coal Beds and Zones in the Northern Rocky Mountains and Great Plains Region. U.S. Geological Survey Professional Paper 1625-A, Chapter PF.
- Hann, W., Havlina, D., Shlisky, A., et al. 2010. Interagency Fire Regime Condition Class (FRCC) Guidebook, Version 3.0. National Interagency Fuels, Fire & Vegetation Technology Transfer (NIFTT). Available online at: http://www.fire.org/nifft/released/FRCC_Guidebook_2010_final.pdf [11/23/2010].

- Haynes (Driver), K. 2011. Pre-field Review for the Threatened, Endangered, Sensitive and Local Concern Plant Species for MBRNF and TBNG, updated May 2011 by K. Driver. On file at MBRNF Supervisor's Office, Laramie, WY.
- Heidel, B. 2008. State Species Abstract Update, *Penstemon haydenii*. Wyoming Natural Diversity Database, University of Wyoming, Laramie, WY.
- Heidel, B. 2007. Update: State Species Abstract – *Spiranthes diluvialis* Ute Ladies' Tresses Family: Orchidaceae. Wyoming Natural Diversity Database, Laramie, WY. Available at: <http://uwadmnweb.uwyo.edu/WYNDD/> [10/17/2011].
- Heidel B. and J. Handley. 2004. *Physaria didymocarpa* (Hook) Gray var. *lanata* A. Nels (common twinpod): A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region Species Conservation Program. Available online at: <http://www.fs.fed.us/r2/projects/scp/assessments/physariadidymocarpavarlanata.pdf> [10/17/2011].
- Kerr-McGee (KM). 2001. Jacobs Ranch Mine Permit #271 North Jacobs Ranch Amendment, Appendix D7. On file with the WDEQ-LQD office in Cheyenne, Wyoming.
- Kerr-McGee (KM). 1979. Jacobs Ranch Mine Permit #271, Appendix D7. On file with the WDEQ-LQD office in Cheyenne, Wyoming.
- Ladyman, J.A.R. 2007. *Tritelia grandiflora* Lindley (largeflower tritelia): A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region Species Conservation Program. Available online at: <http://www.fs.fed.us/r2/projects/scp/assessments/tritelegrandiflora.pdf> [10/17/2011].
- Ladyman, J.A.R. 2006. *Eriogonum visherii* A. Nelson (Visser's buckwheat): A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region Species Conservation Program. Available online at: <http://www.fs.fed.us/r2/projects/scp/assessments/erionumvisseri.pdf> [12/01/2011].
- Love, J.D. and A.C. Christianson. 1985. Geologic Map of Wyoming. US Geological Survey.
- Menakis, J.P., D. Osborne, and M. Miller. 2003. Mapping the Cheatgrass-caused Departure from Historical Natural Fire Regimes in the Great Basin, USA. USDA Forest Service Proceedings RMRS-P-29. Available online at: http://www.fs.fed.us/rm/pubs/rmrs_p029/rmrs_p029_281_288.pdf
- Moore, L., S. Friedley, and D.L. Hazlett. 2006. *Carex alopecoidea* Tuckerman (foxtail sedge): A Technical Conservation Assessment. USDA Forest Service, Rocky

- Mountain Region Species Conservation Program. Available online at:
<http://www.fs.fed.us/r2/projects/scp/assessments/carexalopecoidea.pdf> [05/16/07].
- Nellessen, J.E. 2006a. *Eleocharis elliptica* Kunth (elliptic spikerush): A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region Species Conservation Program. Available online at:
<http://www.fs.fed.us/r2/projects/scp/assessments/eleochariselliptica.pdf>
[10/17/2011].
- Nellessen, J.E. 2006b. *Viburnum opulus* L. var. *americanum* (Mill.) Ait. (American cranberrybush): A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region Species Conservation Program. Available online at:
<http://www.fs.fed.us/r2/projects/scp/assessments/viburnumopulusvamericanum.pdf>
[10/17/2011].
- Nicholoff S.H., compiler. 2003. Wyoming bird conservation plan. Version 2.0. Wyoming Partners In Flight. Lander: Wyoming Game and Fish Department. 668 p. Online:
- Novitzki, R.P., R.D. Smith, and J.D. Fretwell. 1997. Restoration, Creation, and Recovery of Wetlands: Wetland Functions, Values, and Assessment. *In*: National Water Summary on Wetland Resources. United States Geological Survey Water Supply Paper 2425. Available online at:
<http://water.usgs.gov/nwsum/WSP2425/functions.html>
- Ormseth, A. 2011. Personal communication regarding historic mining area within project area [10/14/2011].
- Perryman, B. 2001. Historic Fire Regimes and Shrub Demography: What Does It Mean on the Ground? *In*: Proceedings of the first symposium of the Thunder Basin Grasslands Prairie Ecosystem Association. Pgs 59-65. Available online at:
<http://www.rswyoming.com/TBGPEA/pdf%20files/FirstSymposium/AssnFirstSympWebDoc07.pdf>
- Reyher, Deanna. 2004 (March). *Botrychium lineare* (Narrowleaf grapefern) confirmed in Wyoming. From Castilleja.
<http://www.fs.fed.us/r2/projects/scp/assessments/reyher.pdf> [10/17/2011].
- Ruyle G. and Phil Odgen. 1993. What is an A.U.M.? Arizona Rancher's Management Guide. Arizona Cooperative Extension. Pgs 1-4 Available online at:
<http://ag.arizona.edu/arec/pubs/rmg/1%20rangelandmanagement/1%20aum93.pdf>
[12/28/2011]
- Schuman, G.E. 2002. Mined Land Reclamation in the Northern Great Plains: Have we been Successful? Paper presented at the 2002 National Meeting of the American Society of Mining and Reclamation, Lexington, Kentucky, June 9-13, 2002. Published by ASMR, 3134 Montavesta Road, Lexington, KY 40502. Available online at:

- <http://asmr.us/Publications/Conference%20Proceedings/2002/0842%20Schuman.pdf>
- Schuman, G.E. and S.E. Belden. 2002. Long Term Survival of Direct Seeded Wyoming Big Sagebrush Seedlings on a Reclaimed Mine Site. *Arid Land Research and Management*. Vol. 16, Iss. 4.
- Scott, J. and R.E. Burgan. 2005. Standard Fire Behavior Fuel Models: A Comprehensive Set for use with Rothermel's Surface Fire Spread Model. USDA Forest Service Rocky Mountain Research Station, General Technical Report RMRS-GTR-153-122. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 22 pgs. Available online at: http://www.fs.fed.us/rm/pubs/rmrs_gtr153.pdf
- Seeland, David A. 1992. Depositional Systems of a Synorogenic Continental Deposit - The Upper Paleocene and Lower Eocene Wasatch Formation of the Powder River Basin, Northeast Wyoming. U.S. Geological Survey Bulletin 1917-H.
- Shrestha, G. and L. Ingram. 2007. Influence of reclamation management practices on soil bulk density and infiltration rates on surface coal mines in Wyoming. Available online at: <http://academic.research.microsoft.com/Paper/10692507.aspx>
- Stahl, P.D., B.L. Perryman, S. Sharmasarker, and L.C. Munn. 2002. Topsoil and Stockpiling Versus Exposure to Traffic: A Case Study on In-situ Uranium Wellfields. *Restoration Ecology*. 10(1):129-137. Available online at: <http://onlinelibrary.wiley.com/doi/10.1046/j.1526-100X.2002.10114.x/abstract>
- Stahl, P.D., A.F. Wick, D. Dangi, V. Regula, L.J. Ingram, and D.L. Mummey. 2009. Ecosystem Recovery on Reclaimed Surface Minelands. Paper presented at the 2009 National Meeting of the American Society of Mining and Reclamation, Billings, MT, Revitalizing the Environment: Proven Solutions and Innovative Approaches May 30-June 5, 2009. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.
- Thunder Basin Coal Company (TBCC). 2012. Personal communication with TBCC Safety Department personnel. September 19, 2012.
- Thunder Basin Coal Company (TBCC). 2010a. Black Thunder Mine 2009-2010 Annual Report. On file with the WDEQ-LQD office in Cheyenne, Wyoming.
- Thunder Basin Coal Company (TBCC). 2010b. Jacobs Ranch Mine 2010 Annual Report. On file with the WDEQ-LQD office in Cheyenne, Wyoming.
- Thunder Basin Coal Company (TBCC). 2010c. Wyoming Department of Environmental Quality Chapter 6, Section 2 Permit Modification Application for Black Thunder Mine. Prepared by ENVIRON International Corporation, Lynnwood, Washington. ENVIRON Project No. 29-23571A, July 2010. On file with the WDEQ-AQD office in Cheyenne, Wyoming.

Thunder Basin Coal Company (TBCC) 2010d. Black Thunder Annual Mine Admin Site Meteorological Data Summary 2006-2010.

Thunder Basin Coal Company (TBCC). 2009a. Black Thunder Mine 2008-2009 Annual Report. On file with the WDEQ-LQD office in Cheyenne, Wyoming.

Thunder Basin Coal Company (TBCC). 2009b. Jacobs Ranch Mine 2009 Annual Report. On file with the WDEQ-LQD office in Cheyenne, Wyoming.

Thunder Basin Coal Company (TBCC). 2009c. Black Thunder Mine Permit #233 Appendix D6, 2009 revision. On file with the WDEQ-LQD office in Cheyenne, Wyoming.

Thunder Basin Coal Company (TBCC). 1999. Black Thunder Mine Permit #233 Thundercloud Amendment, Appendix D7. On file with the WDEQ-LQD office in Cheyenne, Wyoming.

Thunder Basin Coal Company (TBCC). 1982. Black Thunder Mine Permit #233 Appendix D7, revised 1982. On file with the WDEQ-LQD office in Cheyenne, Wyoming.

University of Wyoming/State of Wyoming (UW). 2001. Color-infrared Photographs. WGIAC GIS Clearinghouse. <http://wgiac2.state.wy.us/html/doqq752002/43105>. Downloaded July 2007.

U.S. Army Corps of Engineers (USACE). 2011. Omaha District, Wyoming Regulatory Office Black Thunder Mine NWO-2008-00775, North Rochelle Mine NWO-2008-00780, Jacobs Ranch Mine NWO-2007-02721. Available online at: <http://www.nwo.usace.army.mil/html/od-rwy/jur/jurisdiction.htm> [11/30 2011]

U.S. Census Bureau (USCB). 2010. State & County QuickFacts. Campbell County, Wyoming. Available online at: <http://quickfacts.census.gov/qfd/states/56/56005.html>

USDA Farm Service Agency (USDA FSA). 2009. NAIP imagery. Downloaded 2011. Available online at: <http://www.fsa.usda.gov/FSA/apfoapp?area=home&subject=prog&topic=nai>

USDA Forest Service (USFS). 2011. Fire effects information system expanded fire regime table, northern mixed grass prairie. USFS fire effects information system, fire regimes of the US. Available online at: http://www.fs.fed.us/database/feis/fire_regime_table/fire_regime_table.html [11/12/29]

USDA Forest Service (USFS). 2011a. Medicine Bow Routt Schedule of Proposed Actions (SOPA) for Douglas and Thunder Basin Ranger District. Available online

- at: <http://data.ecosystem-management.org/nepaweb/current-sopa.php?forest=110206#6> [12/12/2011]
- USDA Forest Service (USFS). 2002. Land and Resource Management Plan for the Thunder Basin National Grassland, Medicine Bow-Routt National Forest Rocky Mountain Region, 2001. Record of Decision July 2002.
- USDA Forest Service (USFS). 2000. Wildland fire in ecosystems, effects of fire on flora. Rocky Mountain Research Station General Technical Report RMRS-GTR-42-volume 2. J.K, Brown, J. Smith and J. Kapler, editors. 258 pgs. Available online at: http://www.fs.fed.us/rm/pubs/rmrs_gtr042_2.pdf [12/30/2011].
- USDA Forest Service (USFS), 1991, Forest Service Manual, WO Amendment 2600-91-8. Available: http://www.fs.fed.us/im/directives/fsm/2600/2600_zero_code.txt
- USDA Natural Resources Conservation Service (USDA NRCS). 2011a. Soil Survey Geographic (SSURGO) Database for Campbell County, Wyoming, Southern Part. Published 7/6/2011. Available online at: <http://SoilDataMart.nrcs.usda.gov/> [July 2011].
- USDA Natural Resources Conservation Service (USDA NRCS). 2011b. PLANTS Database. National Plant Data Center, Baton Rouge, LA USA. Available online at: <http://plants.usda.gov>. [accessed various dates 2010 and 2011].
- USDA Natural Resources Conservation Service (USDA NRCS). 2010. Web Soil Survey. Available online at: <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx> [10/17/2011].
- USDA Natural Resources Conservation Service (USDA NRCS). 2004. Soil Survey of Campbell County, Wyoming, Southern Part. Part 1 of Parts 1-II. 244 pgs.
- USDA Soil Survey Division Staff (USDA SSDS). 1993. Soil Survey Manual. United States Department of Agriculture Handbook No. 18. Washington, D.C. Pages 48-49 of 437 pgs.
- USDI Bureau of Land Management (USDI BLM). 2012. Wyoming Powder River Basin Federal Coal Lease Status 2011, Tons Produced. Source: WDEQ 2011. Solid Minerals Group, Casper WY. Available online at: http://www.blm.gov/pgdata/etc/medialib/blm/wy/programs/energy/coal/prb_maps.Par.66178.File.dat/prbcoallsestatmap.pdf
- USDI Bureau of Land Management (USDI BLM). 2011a. Land and Mineral Records LR2000 system. Mining Claim information researched on the internet September 6, 2011. <http://www.blm.gov/lr2000/>
- USDI Bureau of Land Management (USDI BLM). 2011b. Analysis and Response of Public Comments Received on the Wright Area Coal Final Environmental Impact

- Statement. U.S. Department of Interior, March 2011. Available online at:
<http://www.blm.gov/wy/st/en/info/NEPA/documents/hpd/Wright-Coal.html>
- USDI Bureau of Land Management (USDI BLM). 2010. Wright Area Coal Lease Applications Final Environmental Impact Statement. U.S. Department of Interior July 2010. Available online at:
<http://www.blm.gov/wy/st/en/info/NEPA/documents/hpd/Wright-Coal.html>
- USDI Geological Survey (USGS). 2010 LANDFIRE: LANDFIRE 1.1.0 Existing Vegetation Type layer. Available online at: <http://landfire.cr.usgs.gov/viewer/> [12/30/2011].
- USDI Fish and Wildlife Service (USFWS). 2011. Federal Endangered, Threatened, and Candidate Species and Designated Critical Habitats that occur in or may be affected by Projects in Campbell County, Wyoming. Updated July 2011. Available online at:
<http://www.fws.gov/wyominges/PDFs/CountySpeciesLists/Campbell.pdf>
- USDI Fish and Wildlife Service (USFWS). 2010. National Wetlands Inventory. Wetlands Data Viewed with Google Earth. Available online at:
<http://www.fws.gov/wetlands/Data/GoogleEarth.html> [06/17/2011]
- USDI Fish and Wildlife Service (USFWS). 2008. BIRDS OF CONSERVATION CONCERN 2008. Division of Migratory Bird Management. Arlington, Virginia.
- USDI Fish and Wildlife Service (USFWS). 2002. Memorandum from Brian T. Kelly (USFWS Field Supervisor, Wyoming Field Office) Providing Black-footed Ferret Block Clearances in Wyoming. Cheyenne, Wyoming.
- US Department of Energy (USDOE). 2007. *Inventory of Assessed Federal Coal Resources and Restrictions to Their Development*. U.S. Departments of Energy, Interior and Agriculture, August 2007. Available online at:
http://www.fossil.energy.gov/epact/epact437_final_rpt.pdf
- US Environmental Protection Agency (USEPA). 2009a. AP 42, Fifth Edition, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. October 14, 2009. Available online at:
<http://www.epa.gov/ttn/chief/ap42/index.html>
- US Environmental Protection Agency (USEPA). 2009b. NONROAD Model. July 2009. Available online at: <http://www.epa.gov/otaq/nonrdmdl.htm>
- Western Regional Climatic Center (WRCC). 2012. Rochelle 3 E, Wyoming (487810) Period of Monthly Climate Summary for 3/22/1927-3/31/2002. Available online at: <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wy7810> [5/08/2012].

- Western Regional Climatic Center (WRCC). 2012a. Rochelle 3 E, Wyoming (487810) NDCD 1981-2010 Monthly Normals. Available online at: <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wy7810> [5/08/2012].
- Williams, M. I., Schuman, G. E., Hild, A. L. and Vicklund, L. E. (2002), Wyoming Big Sagebrush Density: Effects of Seeding Rates and Grass Competition. *Restoration Ecology*, 10: 385–391. doi: 10.1046/j.1526-100X.2002.01025.x
- Wyoming Department of Employment (WYDOE). 2012. Wyoming Jobless Rate Unchanged at 5.8% in December 2011. Wyoming Department of Workforce Services, Research & Planning, January 24, 2012. Available online at: <http://doe.state.wy.us/lmi/news.htm>
- Wyoming Department of Employment (WYDOE). 2011. Table 65: Wyoming Employing Units, Employment, & Wages by NAICS Subsectors for Campbell County - Northeast Region - Second Quarter 2011. Available online at: http://wydoe.state.wy.us/lmi/11Q2_QCEW/11q2t65.htm.
- Wyoming Department of Environmental Quality-Air Quality Division (WDEQ-AQD). 2010. Permit Application Analysis AP-10986 for Thunder Basin Coal Company, Black Thunder Mine. December 15, 2010. On file with the WDEQ-AQD office in Cheyenne, Wyoming.
- Wyoming Department of Environmental Quality-Land Quality Division (WDEQ-LQD). 1994. Guideline No. 1 Topsoil and Overburden, rules update 1994 inc. selenium update 1996. 43 pgs. Available online at: <http://deq.state.wy.us/lqd/guidelns/guide1.pdf> [12/14/2011]
- Wyoming Department of Environmental Quality-Water Quality Division (WDEQ-WQD). 2001. Wyoming Surface Water Classification List. Available online at: <http://deq.state.wy.us/wqd/watershed/surfacestandards/Downloads/Standards/2-3648-doc.pdf>
- Wyoming Mining Association (WMA). 2010. The Concise Guide to Wyoming Coal. Available online at: <http://www.wma-minelife.com/coal/CONG2011/ConciseGuide2011.pdf>
- Wyoming Natural Diversity Database (WYNDD). 2011. Confirmation of species heritage rank. Online: <http://uwadmnweb.uwyo.edu/wyndd/info.asp?p=3682> [10/17/2011].
- Wyoming Oil and Gas Conservation Commission (WOGCC). 2011. Well summary by county. Available online at: <http://wogcc.state.wy.us/CntySummary.cfm?oops=1> [12/12/2011]
- Wyoming Oil and Gas Conservation Commission (WOGCC). 2010a. Oil and gas well information. Available online at: <http://wogcc.state.wy.us>. [September 2010]

Wyoming Oil and Gas Conservation Commission (WOGCC). 2010b. Coal bed natural gas well information Available online at: <<http://wogcc.state.wy.us>>. [September 2010]

Wyoming State Engineer's Office (SEO). 2011. e-Permit. Available online at: <<https://seoweb.wyo.gov/e-Permit/Common/Login.aspx>>. [12/6/2011].

Wyoming State Engineer's Office (SEO). 2010. e-Permit. Available online at: <<https://seoweb.wyo.gov/e-Permit/Common/Login.aspx>>. [9/1/2010]

Wyoming Water Resources Center (WRRC). 1997. A Study of Techniques to Assess Surface and Groundwater Impacts Associated with Coal Bed Methane and Surface Coal Mining, Little Thunder Creek Drainage, Wyoming. University of Wyoming. Page 3-13 of 316 pgs. Available online at: <http://library.wrds.uwyo.edu/wrp/97-04/97-04.pdf>